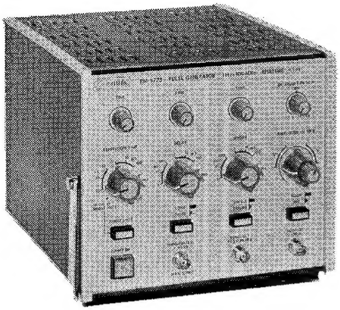
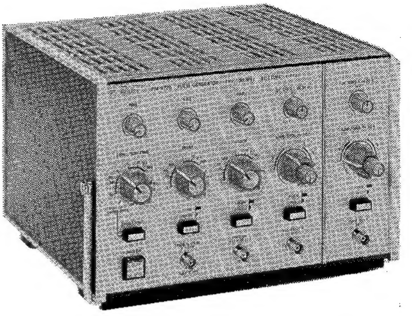




PHILIPS

MANUAL

PULSE GENERATORS 1 Hz – 100 MHz

PM 5775 - PM 5776

9446 057 75..1 9446 057 76..1

9499 460 04711

1/1171

CONTENTS

GENERAL

DIRECTIONS FOR USE

SERVICE DOCUMENTATION

ST OF FIGURES

GENERAL

I. INTRODUCTION

The single output pulse generator PM 5775 and the dual output pulse generator PM 5776 provide output pulses with a fixed risetime of less than 1 nanosecond and a repetition rate of 1 Hz ... 100 MHz.

The fast risetime and the extended frequency range combined with other features like double pulse generation, gated output pulses etc. make the instruments particularly appropriate as a test signal source for a wide variety of objects, such as fast logic and switching circuits, memory circuits, delay lines and networks.

TECHNICAL DATA

perties, expressed in numerical values with statement of tolerances are guaranteed by the factory. nerical values without tolerances are intended for information purposes only and indicate the perties of an average instrument.
numerical values hold good for nominal mains voltage.

ECTRICAL

Internal triggering		
Repetition rate		1 Hz . . . 100 MHz Variable in 9 ranges with continuous control within the ranges
Jitter		Less than 0.1 % or 50 ps whichever is greater
Temperature coefficient		Less than 0.1 % per °C
External triggering		
Triggering:	input voltage	+ 1.2 V required to gate the generator
	input impedance	approx. 1 kΩ
	frequency range	DC ... 50 MHz
Gating:	input voltage	+ 1.2 V
Triggering delay		From TRIGG IN to SYNC OUT approx. 12 ns
Single-shot operation		Single-shot facility by means of push- button
Pulse width		
Range		5 ns ... 100 ms Variable in 8 ranges with continuous control within the ranges
Duty cycle		Approaching 100% using inverted-pulse output (limited only by minimum width) greater than 50% in normal operation
Jitter		Less than 0.1% or 50 ps whichever is greater
Temperature coefficient		0.1% per °C
Pulse delay		
Range		5 ns ... 100 ms Variable in 8 ranges with continuous control within the ranges
Jitter		Less than 0.1% or 50 ps whichever is greater
Temperature coefficient		0.1% per °C

	Double pulse	Double pulse mode provides "twin" pulses at set delay with simultaneously controlled pulse width
6.	**Sync. output**	Square wave, amplitude +1.5 V into 50Ω (+ 5 V open circuit) Pulse occurs approx. 30 ns before the main pulse
7.	**Output pulse**	Both outputs of the PM 5776 are identical and have the same specification as the PM 5775 output
	Source impedance	50Ω
	Voltage output	300 mV – 3 V into external 50Ω
	Attenuator	3 V and 1 V Continuous control provides overlap between 1 and 3 V
	Rise and fall time	0.9 ns ± 0.2 ns measured at + or –3 V in position NORMAL and d.c.-offset 0 V
	Waveform aberration	⩽ ± 5% of max. amplitude at d.c.-offset 0 V
	Polarity	Positive or negative Normal or inverted
	Protection	Against short and open circuit
	Base line d.c.-offset	± 1.5 V into 50Ω Continuously variable
	Output connectors	BNC
8.	**Temperature range**	0 ... 40 °C
9.	**Mains supply**	
	Mains voltage	100 ... 130 V and 200 ... 260 V switchable
	Mains frequency	50 - 400 Hz
	Power consumption	PM 5775: approx. 90 VA PM 5776: approx. 110 VA

MECHANICAL

			PM 5775	PM 5776
1	**Maximum dimensions (mm)**	Depth	301	301
		Width	231.6	301.6
		Height	192	192

2.	**Weight**	PM 5775: approx. 7 kg

I. ACCESSORIES

andard accessories (supplied with the instrument)

1 manual
1 mains flex

ptional accessories (to be ordered separately)

Termination 50 Ω, 1 W	PM 9585
Mixing piece 50 Ω	PM 9584
Subnano second mixing piece	PM 9583

Coaxial cables, 50 Ω, type RG58A-U with BNC connectors *

Service code nr.	*Length(mm)*	*Delay (ns)*
5322 320 10009	200	1
5322 320 10011	400	2
5322 320 10012	600	3
5322 320 10013	1980	10

The commercial department delivers under number PM 9588 a plastic pouch containing the following cables:

5 coaxial cables, delay 1 ns
4 coaxial cables, delay 2 ns
3 coaxial cables, delay 3 ns
3 coaxial cables, delay 10 ns

IV. DESCRIPTION OF THE BLOCK DIAGRAM (Figs. IV-1 and IV-2)

Trigger circuit

The pulse generator can be triggered either externally or internally. The trigger circuit (I) consists of a Schmitt-trigger controlled by external trigger or gate pulses which are applied to socket TRIGG/GATE IN, P1.
When switch REPETITION TIME, S1, is in position TRIGG. OR SINGLE SHOT, a single pulse is obtained by depressing push-button SINGLE SHOT, S5.

Astable multivibrator

This multivibrator (II) supplies square-wave pulses from which all internal pulses are derived. Controls REPETITION TIME, S1 and RV1, enable adjustment of the repetition time between 10ns and 1 s, both in steps and continuously.
The multivibrator is inoperative when switch REPETITION TIME, S1, is in position TRIGG. or SINGLE SHOT.

Gate

Both the external and internal trigger pulses are fed to gate III.
With switch CONT. GATED, S6, in position CONT. the internal trigger pulses will pass the gate directly. If, however, switch CONT. GATED, S6, is set to position GATED the internal trigger pulses will pass the gate only when a gate signal is applied to socket TRIGG/GATE IN, P1. This means that a pulse train can be obtained which is synchronised with the applied gate pulse.

Differential amplifier and delay circuit

The square-wave pulses, either from the multivibrator or from the trigger circuit, are applied via the sync. output pulse amplifier IV to differential amplifier (V).
From socket SYNC. OUT, P2, square-wave pulses can be taken with an amplitude of 1.2 V. In the differential amplifier V the square-wave pulses are converted into needle pulses of 4 ns width which control the delay-time circuit (VI). In the latter square-wave pulses are formed whose width can be adjusted from 5 ns . . . 0.1 s by means of the DELAY controls, S2 and RV2.
After amplification in the differential amplifier (VII) positive as well as negative square-wave pulses are obtained which are differentiated directly. The needle pulses which originate from the trailing edges can be delayed with respect to the needle pulses that originate from the leading edges.
The following differential amplifier (VIII) delivers a trigger pulse when a negative and a positive needle pulse are applied simultaneously. When switch SINGLE DOUBLE, S7, is set to position SINGLE the amplifier is controlled by the delayed needle pulses, whereas in position DOUBLE the amplifier is controlled both by the delayed and the initial needle pulses.
In this way single or double needle pulses are obtained at the output of the amplifier.

)ifferential amplifier and pulse width circuit

The pulse width circuit (IX) is triggered by the needle pulses coming from the amplifier circuit (VIII). In this circuit square-wave pulses are formed, whose pulse width is adjustable from 5 ns . . . 0.1 s with controls WIDTH, S3 and RV3.
When switch SINGLE DOUBLE, S7, is in position SINGLE only a single pulse is obtained. By switching to position DOUBLE the pulse width circuit is also triggered by the needle pulse which originates from the leading edge of the "delay pulse".
Consequently double pulses are obtained. The second pulse can be delayed with respect to the first one but both pulses have the same pulse width.

ımplifiers

The signal from the pulse-width circuit is applied to an amplifier (X) with two outputs. One output supplies positive-going pulses and the other one negative-going pulses. The signals are supplied to a chain of differential amplifiers (XII) through the NORM. INV. switch, S8, and one section of the AMPLITUDE IN 50 Ω switch, S4.
The differential amplifiers feed the driver stage (XIII) with positive-going or negative-going pulses depending on the settings of switches NORM.INV., S8, and AMPLITUDE IN 50 Ω, S4. The pulse diagram illustrates the interaction of the switches.

ʼriver and output stage

The driver is an amplifier which controls the current through the output stage (XIV). This current is also continuously adjustable with front panel vernier AMPLITUDE IN 50 Ω, RV5.

urrent source, positive pulse out

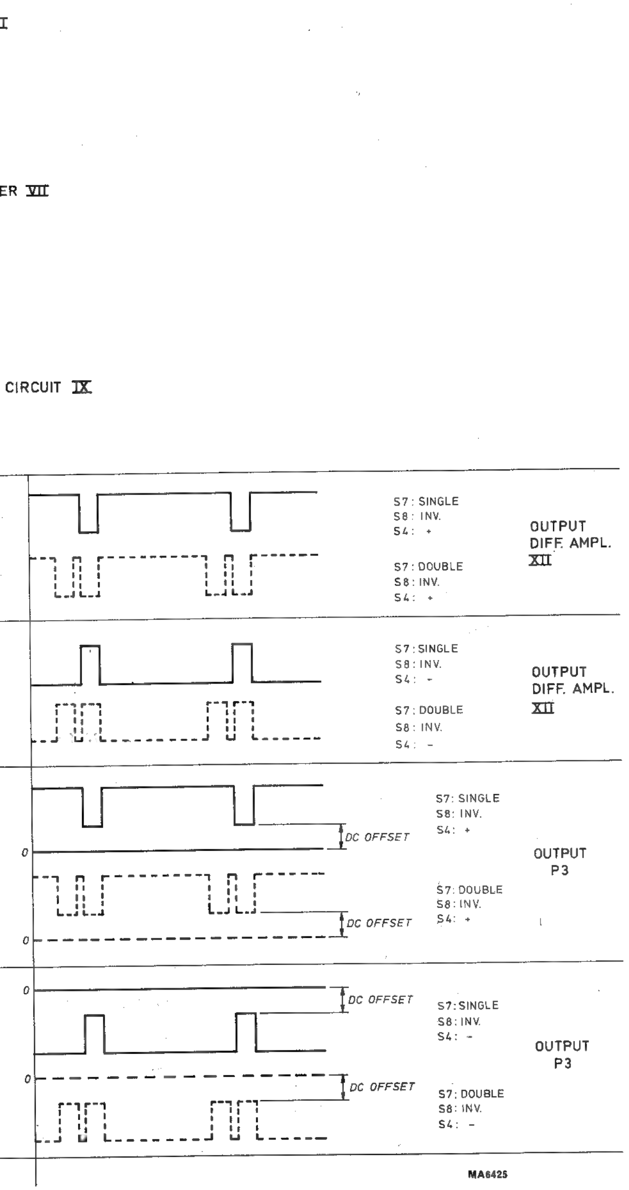
When leaving the output stage, the pulses are negative and either positive-going or negative-going. To obtain a positive pulse in positions +1 V and +3 V of switch AMPLITUDE IN 50 Ω, S4, a positive current is added to the output pulse.

.ttenuator and d.c. offset

Switch AMPLITUDE IN 50 Ω, S4, also controls the attenuator (XVI), consisting of two reed-relays which switch in a resistive network in the +1 V and –1 V positions.
Base-line shift both in positive and negative direction is possible by adding a direct current to the output pulse. The current is supplied by the d.c. offset circuit and is continuously adjustable with control DC OFFSET IN 50 Ω, RV4.

M 5776

The signals at the outputs of amplifier (X) are tapped off to a second output channel, identical to that of PM 5775. The normal inverted mode, the positive or negative mode, the amplitude and d.c. offset can be individually chosen.



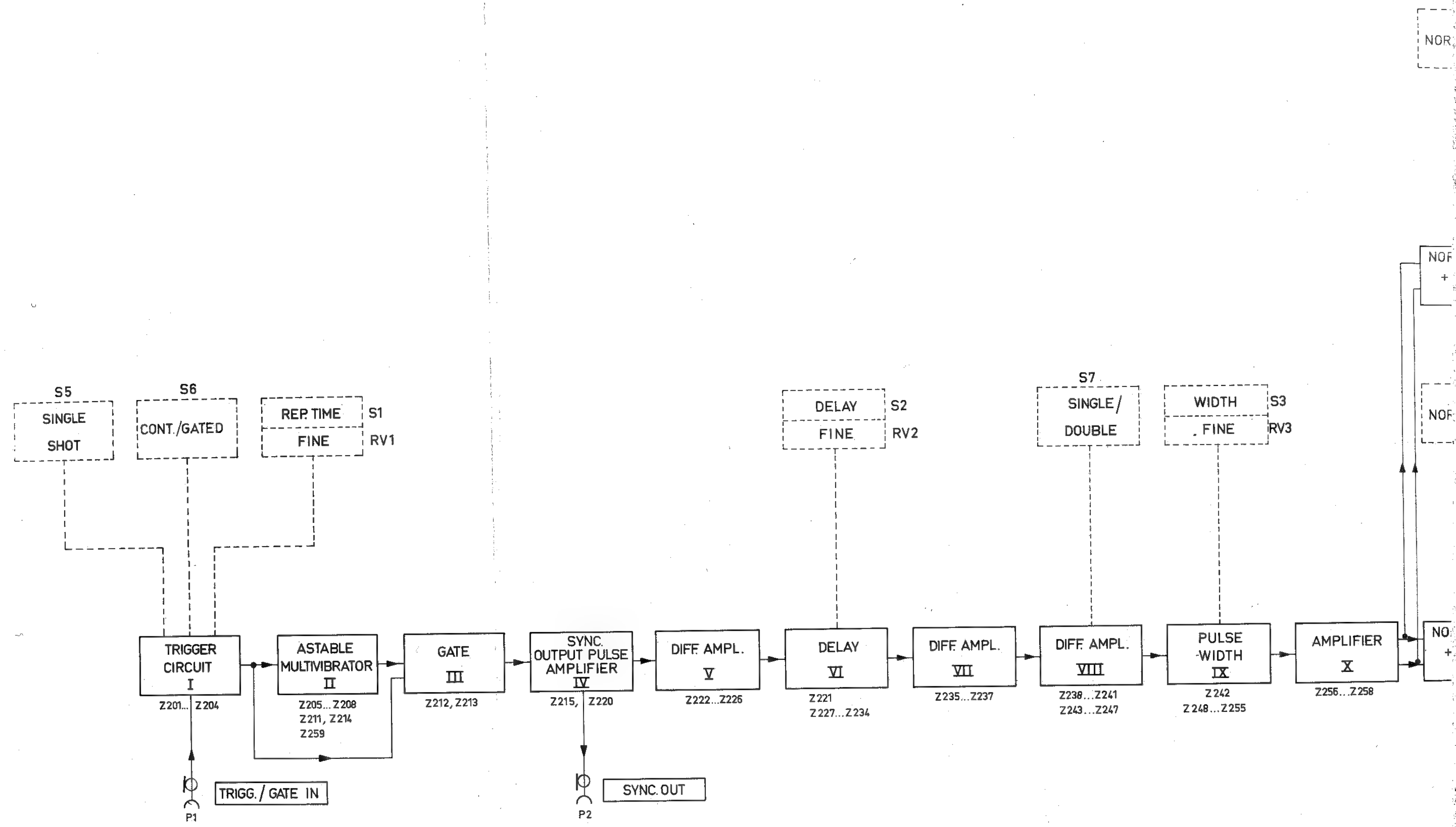
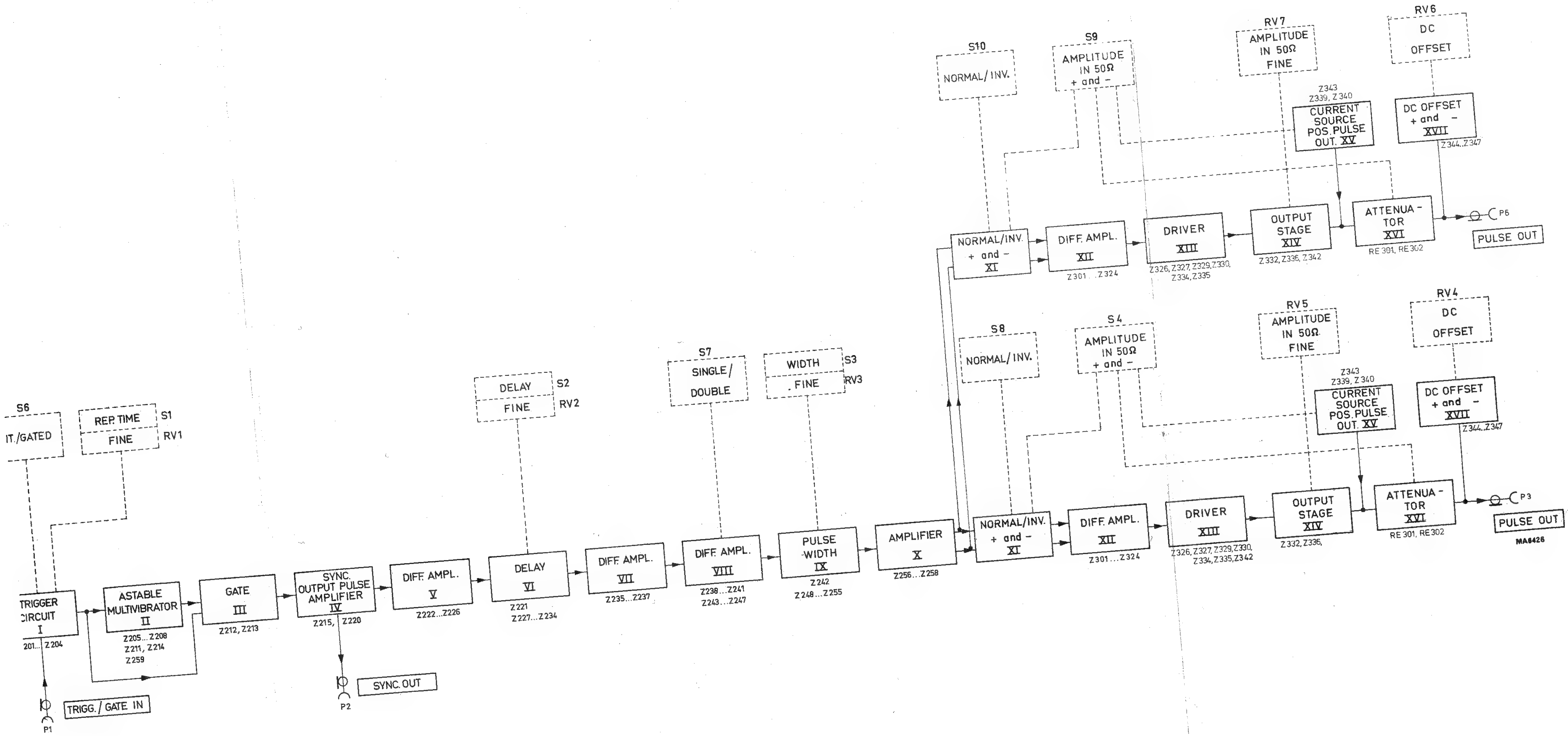


Fig. IV-2. Block diagram


S6
IT./GATED
REP. TIME
FINE
S1
RV1
TRIGGER CIRCUIT I
201... Z204
ASTABLE MULTIVIBRATOR II
Z205...Z208
Z211, Z214
Z259
GATE III
Z212, Z213
SYNC. OUTPUT PULSE AMPLIFIER IV
Z215, Z220
DIFF. AMPL. V
Z222...Z226
DELAY
FINE
S2
RV2
DELAY VI
Z221
Z227...Z234
DIFF. AMPL. VII
Z235...Z237
S7
SINGLE/ DOUBLE
DIFF. AMPL. VIII
Z238...Z241
Z243...Z247
WIDTH
FINE
S3
RV3
PULSE WIDTH IX
Z242
Z248...Z255
AMPLIFIER X
Z256...Z258
TRIGG./GATE IN
P1
SYNC. OUT
P2
S10
NORMAL/INV.
S9
AMPLITUDE IN 50Ω + and −
RV7
AMPLITUDE IN 50Ω FINE
RV6
DC OFFSET
Z343
Z339, Z340
CURRENT SOURCE POS. PULSE OUT. XV
DC OFFSET + and − XVII
Z344...Z347
NORMAL/INV. + and − XI
DIFF. AMPL. XII
Z301...Z324
DRIVER XIII
Z326, Z327, Z329, Z330, Z334, Z335
OUTPUT STAGE XIV
Z332, Z336, Z342
ATTENUA-TOR XVI
RE301, RE302
P6
PULSE OUT
S8
NORMAL/INV.
S4
AMPLITUDE IN 50Ω + and −
RV5
AMPLITUDE IN 50Ω FINE
RV4
DC OFFSET
Z343
Z339, Z340
CURRENT SOURCE POS. PULSE OUT. XV
DC OFFSET + and − XVII
Z344...Z347
NORMAL/INV. + and − XI
DIFF. AMPL. XII
Z301...Z324
DRIVER XIII
Z326, Z327, Z329, Z330, Z334, Z335, Z342
OUTPUT STAGE XIV
Z332, Z336,
ATTENUA-TOR XVI
RE301, RE302
P3
PULSE OUT
MA6426

iagram

DIRECTIONS FOR USE

V. INSTALLATION

A. SETTING UP

Always place the instrument so that the air circulation through the airvents in the bottom plate and the top cover is not impeded. Otherwise the instrument will not be properly cooled. The ambient temperature may not exceed +40 °C.

B. ADJUSTMENT TO THE LOCAL MAINS VOLTAGE

The mains voltage selector S12 at the rear of the instrument can be set to two ranges:

Position	Voltage range	
115 V	100 . . . 130 V~	Frequency 50 . . . 400 Hz
230 V	200 . . . 260 V~	

The selector can be operated with a screwdriver through a hole in the rear panel. When changing from 230 V to 115 V, insert the screwdriver in the groove and push upwards.
On delivery the instrument is adjusted to a mains voltage of 200 . . . 260 V.

C. EARTHING

The instrument should be earthed according to the local safety regulations.
This may be effected as follows:
– via the 3-core mains flex
– via the earthing terminal P5 at the rear of the instrument.

DOUBLE EARTH CONNECTIONS SHOULD BE AVOIDED BECAUSE THEY MAY CAUSE HUM!

D. SWITCHING ON

The instrument is switched on by depressing push-button POWER ON, S11. The indicator lamp, LA1, in the push-button will then light up.

E. FUSES

The instrument is provided with three fuses:

– one thermal fuse mounted on the primary of the mains transformer.
– two delayed-action fuses on the secondary side of the mains transformer, located on printed wiring board 1.

'. CONTROLS, INPUT AND OUTPUT CONNECTORS

'his survey refers to both PM 5775 and PM 5776.
Control or connector number within brackets applies to PM 5776 only.

Contfol or onnector	Designation	Purpose
51	REPETITION TIME TRIGG. or SINGLE SHOT	Control of repetition time in 8 steps Selection of single shot operation or external triggering.
RV 1	FINE	Fine control of repetition time. Provides overlap between ranges.
2	DELAY	Control of delay time in 8 steps
.V2	FINE	Fine control of delay time. Provides overlap between ranges
3	WIDTH	Control of pulse width in 8 steps
.V3	FINE	Fine control of pulse width. Provides overlap between ranges
V4 (RV6)	DC OFFSET IN 50 Ω	Continuous base-line shift control of ± 1.5 V
4 (S9)	AMPLITUDE IN 50 Ω	Step control of output pulse attenuation. Selection of positive-going or negative-going output pulses
V5 (RV7)		Fine control of attenuation
5	SINGLE SHOT	When S1 is set to position TRIGG. OR SINGLE SHOT, one single pulse is produced when S5 is pressed.
5	CONT. GATED	Selection of continuous or gated pulse mode
7	SINGLE DOUBLE	Selection of single or double pulse
3 (S10)	NORM. INV.	Selection of normal or inverted output pulses
.1	POWER ON	Mains switch

	Purpose
	Indicator lamp in POWER ON switch
'E IN	Input connector for triggering or gating pulses
	Output connector for square-wave signal. Sync.output pulse appears 30 ns before main output pulse.
	Output connector for main pulse.
	Input connector for mains supply
	Earthing connector
	Mains voltage selector

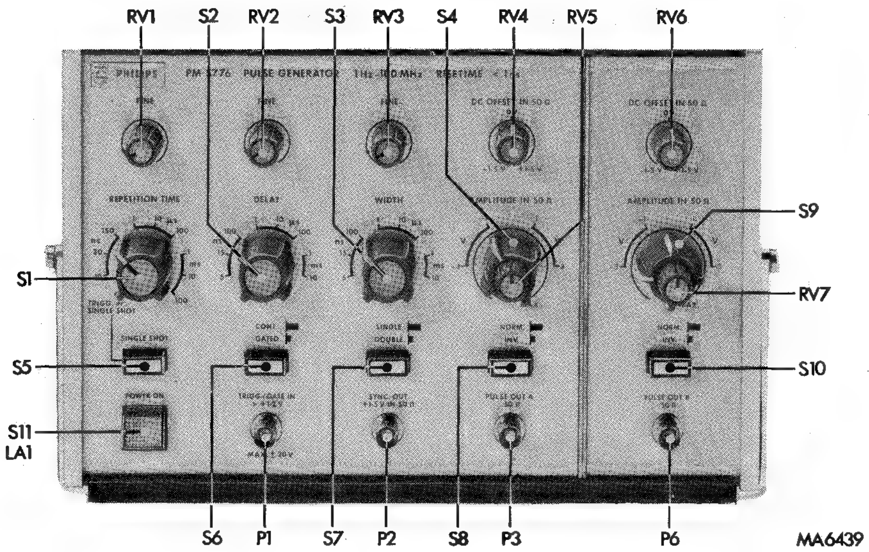


Fig. V-1. Indication of controls, input/output sockets at the front of PM 5776

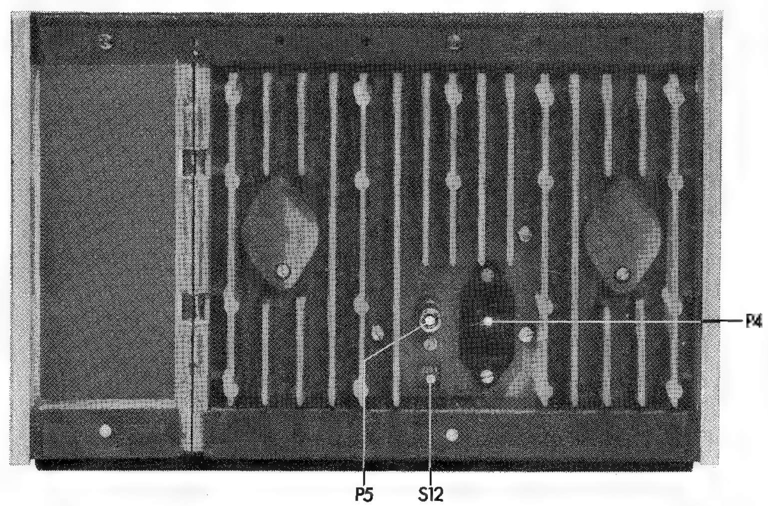


Fig. V-2. Indication of controls, input sockets at the rear of PM 5776

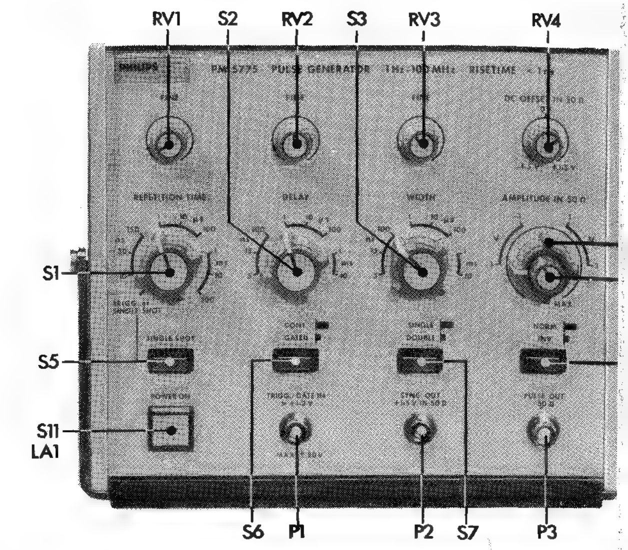


Fig. V-3. Indication of controls, input/output sockets at

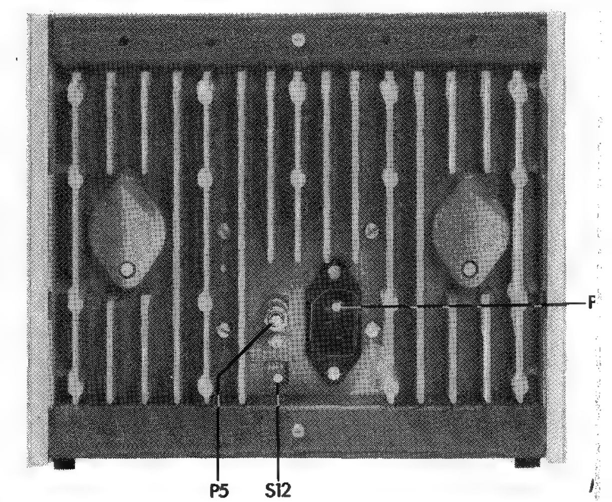


Fig. V-4. Indication of controls, input sockets at the r

)WER ON switch

triggering or

)r square-wave
pulse appears
utput pulse.

)r main pulse.

mains supply

)r

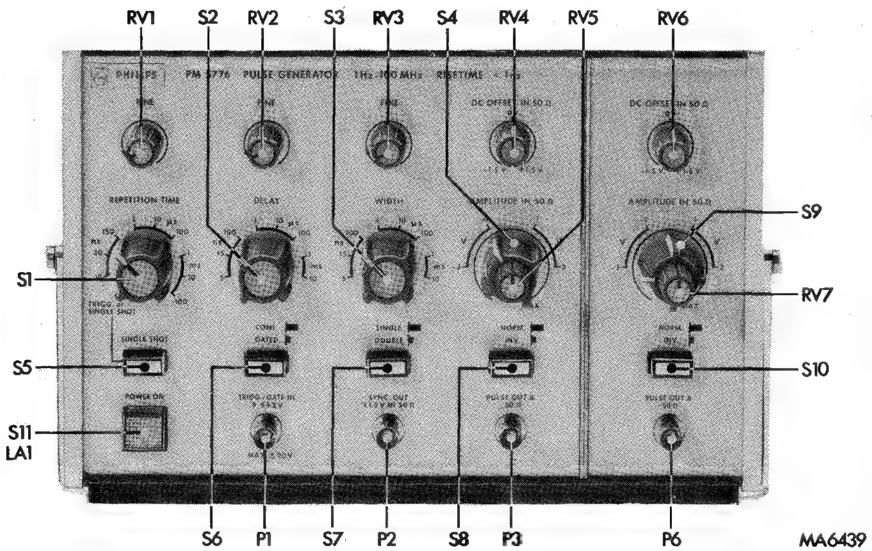


Fig. V-1. Indication of controls, input/output sockets at the front of PM 5776

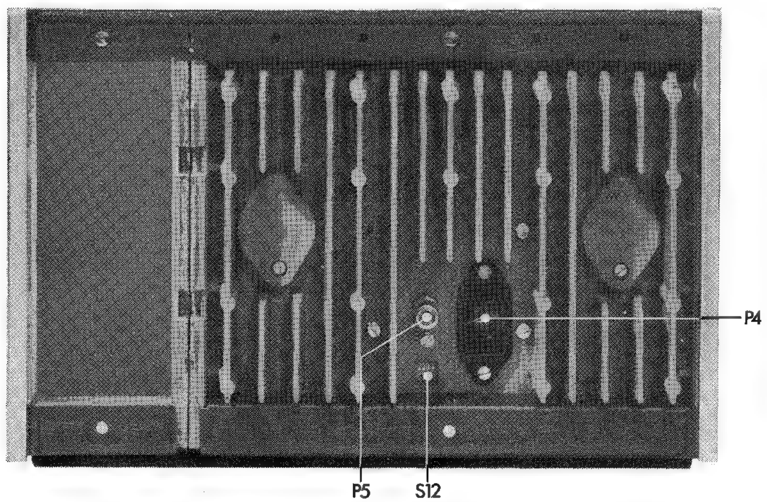


Fig. V-2. Indication of controls, input sockets at the rear of PM 5776

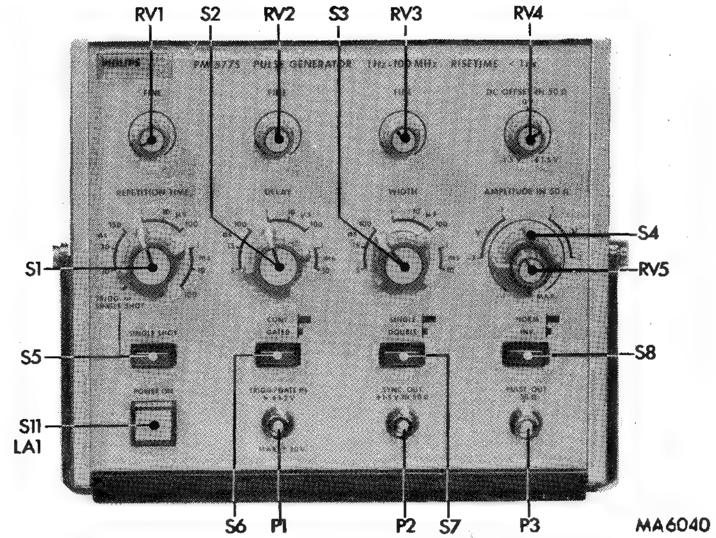


Fig. V-3. Indication of controls, input/output sockets at the front of PM 5775

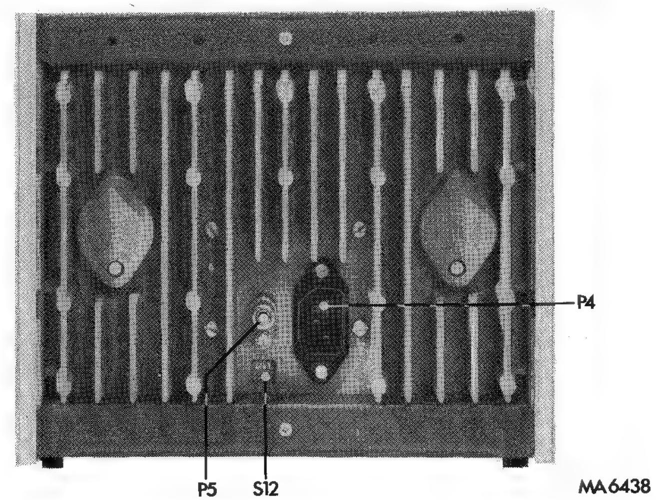


Fig. V-4. Indication of controls, input sockets at the rear of PM 5775

VI. OPERATION

Note: External d.c. voltages of up to ± 3 V can be applied to the PULSE OUT connector(s) of PM 5775 (PM 5776). Higher voltages may damage the instrument.

A. FAMILIARIZING WITH THE INSTRUMENT

A.1. General

To become familiar with the PM 5775 or PM 5776 it is recommended to exercise the procedure in paragraphs A.2 . . . A.11, in which the function of controls and input/output connectors is explained.

In the set-up a PHILIPS sampling oscilloscope PM 3400 is used. Its bandwidth of 1.7 GHz permits reproduction of the PM 5775 (PM 5776) output risetime of less than 1 nano-second with a negligible error.

A.2. Preliminary control settings (see Figs. V-1 . . . V-4)

		PM 5775	PM 5776
S1	REPETITION TIME	1 μs	1 μs
RV1	FINE	black dot	black dot
S2	DELAY	5 ns	5 ns
RV2	FINE	black dot	black dot
S3	WIDTH	100 ns	100 ns
RV3	FINE	black dot	black dot
S4	AMPLITUDE IN 50 Ω	+1 V	+1 V
RV5	vernier	MAX.	MAX.
RV4	DC OFFSET IN 50 Ω	0 V	0 V
S6	CONT./GATED	CONT.	CONT.
S7	SINGLE DOUBLE	SINGLE	SINGLE
S8	NORM. INV.	NORMAL	NORMAL
RV6	DC OFFSET IN 50 Ω	–	0 V
S9	AMPLITUDE IN 50 Ω	–	+1 V
RV7	vernier	–	MAX.
S10	NORM. INV.	–	NORMAL

ttings of the PM 3400 controls

	Pulse generator used PM 5775	PM 5776
SENSITIVITY	SYNC	SYNC
TRIGG.	EXT.–	EXT.–
TIME SCALE MAGN.	1, CAL	1, CAL
TIME/cm	0.2 μs	0.2 μs
TIME POSITION	fully clockwise	fully clockwise
Horizontal mode	NORMAL	NORMAL
SAMPLES/cm	2 o'clock	2 o'clock
Vertical mode	A	A and B
NORMAL/SMOOTHED	NORMAL	NORMAL
POSITION A	Midrange	Midrange
POSITION B	–	Midrange
mV/cm, A	20, CAL.	20, CAL.
mV/cm, B	–	20, CAL.

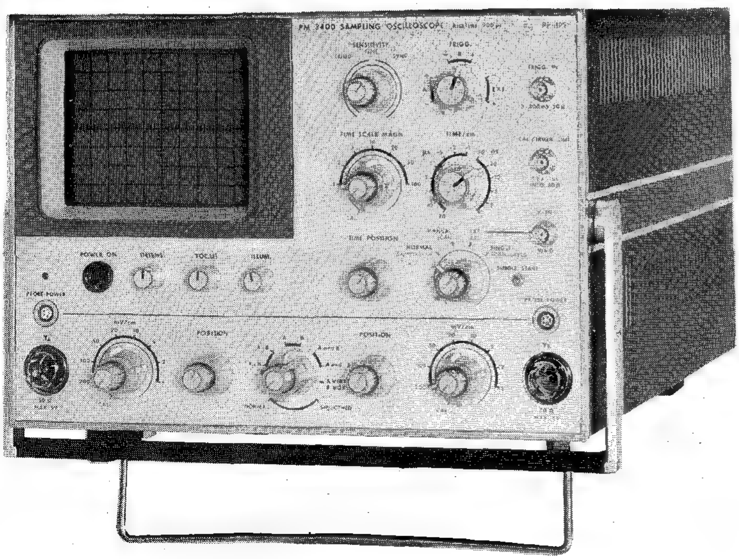


Fig. VI-1. PHILIPS sampling oscilloscope PM 3400

A.3. Connections

- Ensure that the mains voltage switch S12 is set to the appropriate mains voltage.
- Connect the PM 5775 (PM 5776) to the mains. Depress switch POWER ON, S11, switch on the oscilloscope and let the instruments warm up for about 10 minutes before proceeding.

Note: The instructions below refer to PM 5775, but are also applicable to PM 5776. Just connect the second PULSE OUT socket, P6, to channel B of the oscilloscope and exercise the same procedure as described for channel A.

- Connect the pulse-generator output PULSE OUT, P3, to input A of the oscilloscope via a 50 Ω coaxial cable and a 20 dB attenuator (e.g. General Radio Type GR 874 G20).
- Connect the pulse-generator output SYNC. OUT, P2, to the TRIGG.IN connector of the oscilloscope via a 50 Ω coaxial cable and a 20 dB attenuator (e.g. Texscan type FP50 BNC outline A).
- Turn the SENSITIVITY control to the TRIGG. range. Keep turning until a stable display is obtained.

A.4. Controls REPETITION TIME, DELAY and WIDTH

Repetition time, delay time and pulse width are defined in Fig. VI-2, which also shows the correct relationship between them.

The FINE controls, repetition time, delay and width, RV1 . . . RV3, provide overlap between the subsequent ranges of the switches.
Repetition time, delay time and pulse width correspond approximately to the indicated values when the FINE controls RV1-RV2-RV3 are set to the black dots. These dots do not coincide with the lowest position of the FINE controls to ensure overlap.

Example : With the REPETITION TIME switch in position 1 μs, a range between approximately 0.9 μs and 11 μs can be covered by the FINE control.

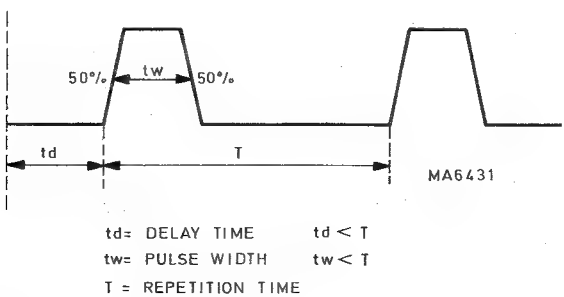
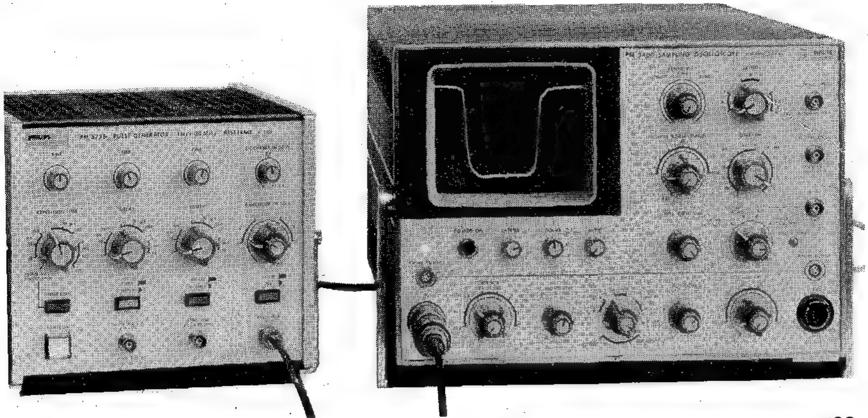
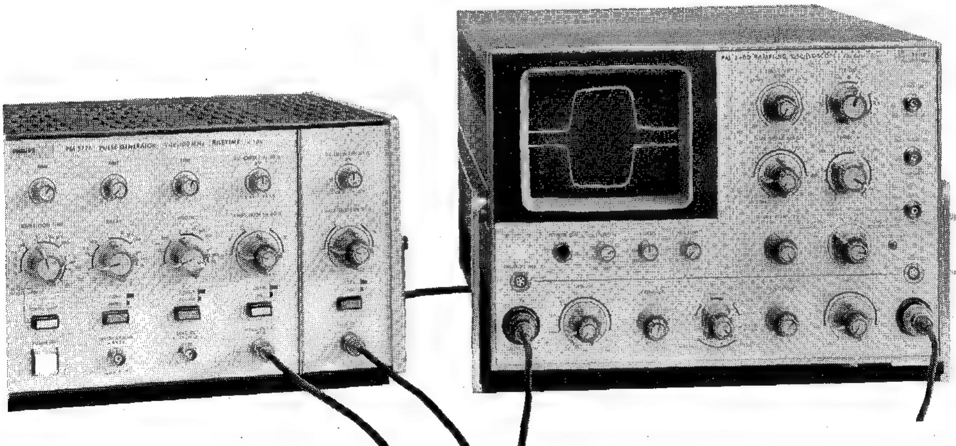


Fig. VI-2. Time settings at single-pulse operation



MA6435

7-3. *Set-up monitoring the output pulse of PM 5775*



MA 6436

7-4. *Set-up monitoring the simultaneous output pulses of PM 5776*

A.5. Controls AMPLITUDE IN 50 Ω

Using switch AMPLITUDE in 50 Ω, S4, positive or negative polarity of the output pulse can be obtained. The output amplitude can also be set to ± 1 or ± 3 V. The vernier, RV5, provides overlap between the amplitude ranges. Hence, the amplitude can be continuously adjusted from approximately 0.3 V (vernier fully counter-clockwise) to the maximum 3 V (vernier fully clockwise).

A.6. Switch NORM. INV.

The output pulse can be inverted by depressing push-button NORM. INV. In the NORMAL mode the duty cycle is limited to 80 – 85 %. It can be increased to almost 100 % in the INVERTED mode, only limited by the minimum pulse width. The simplified pulse diagram Figure VI-5 illustrates the different modes.

OUTPUT PULSE	SETTINGS	
	S4 (S9) AMPLITUDE IN 50Ω	S8 (S10) NORMAL / INV.
	+ 3 V	NORMAL
	+ 3 V	INV.
	- 3 V	INV.
	- 3 V	NORMAL

MA6434

Fig. VI-5. Interaction of positive-going and negative-going pulses at normal and inverted pulse operation

7. **Control DC OFFSET IN 50 Ω**

A base-line shift of ± 1.5 V is obtained using this control. It is locked in the 0 V position to ensure that no d.c. offset is introduced by accident.
The total sum of pulse amplitude and d.c. offset is maximum ± 4.5 V.

8. **Switch SINGLE/DOUBLE**

Change the settings of the pulse generator (paragraph A.2) as follows:
DELAY, S2, 100 ns.
Turn the delay FINE control clockwise and observe the double pulse on the oscilloscope screen.
In the DOUBLE pulse mode, the relationship between repetition time, pulse width and delay time must be as shown in Figure VI-6. The relationship $t_w < t_d < T$ implies that the duty cycle has to be less than 50 %.
Also turn the pulse-width FINE control, RV3, and observe that the width of the twin pulses is simultaneously controlled.

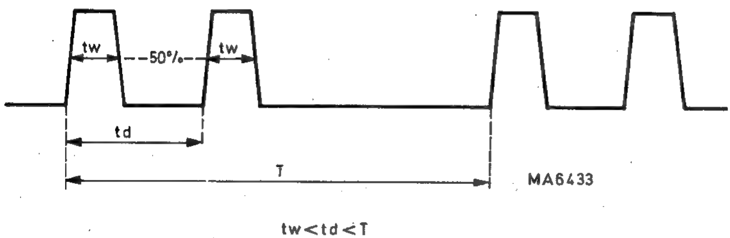


Fig. VI-6. Time settings at double-pulse operation

9. **SYNC. output**

To trigger external equipment a square-wave signal is available at this output. The leading edge of the trigger pulse appears approximately 30 ns before the leading edge of the main pulse (normal and positive operation). The amplitude is +1.5 V into 50 Ω.

A.10. Switch GATED/CONT, input TRIGG/GATE IN

In position CONT., the internal multivibrator is in operation. The GATED mode is used for internal operation, externally gated. A gating signal applied to input TRIGG/GATE IN, P1, will control the output so that burst pulses are obtained. The length of each burst is determined by the gate pulse width. The correct relationship between the pulse-width and repetition time of the PM 5775 (PM 5776) and those of the external pulse source are shown in Figure VI-7.

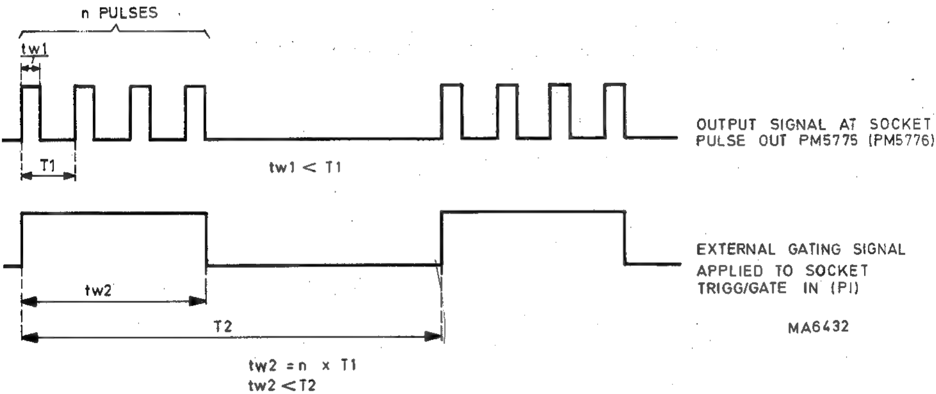


Fig. VI-7. Time settings at gated-pulse operation

A.11. Switch REPETITION TIME, position TRIGG. or SINGLE SHOT

In this position the internal multivibrator is inoperative. By applying a trigger signal of at least 1.2 V amplitude to input TRIGG./GATE IN, P1, the pulse generator is controlled externally.
One pulse is obtained by depressing the SINGLE SHOT switch, S5.

3. BRIEF DIRECTIONS FOR DIFFERENT OPERATING MODES

3.1. Internal single pulse operation

- Release switches CONT. GATED, S6, SINGLE DOUBLE, S7, and NORM./INV., S8, (positions CONT., SINGLE and NORM.).
- Set control DC OFFSET IN 50 Ω, RV4, to 0 V.
- Set switch DELAY, S2, to 5 ns and turn its FINE control, RV2, fully counter-clockwise.
- Set switch REPETITION TIME, S1, to the required value and check that the pulse width is less than half the repetition time.
- Set switch AMPLITUDE IN 50 Ω, S4, to required level and polarity. If necessary, adjust with the FINE control, RV4.
- Connect PULSE OUT, P3, to the test object via a 50 Ω termination (e.g. 3 W, 50 Ω termination PM 9581).
- If required, depress switch NORM. INV., S8, to obtain inverted pulses.

3.2. Internal double-pulse operation

- Release switches CONT. GATED, S6, and NORM. INV., S8, (positions CONT. and NORM.).
- Depress switch DOUBLE, S7.
- Check that the relationship between pulse width, delay time and repetition time is correct ($t_W < t_d < T$). See Figure VI-6.
  The duty cycle is less than 50 % in normal operation.
  Control the distance between the twin pulses by turning FINE control RV2.

3.3. Internal operation, externally gated

- Depress switch CONT. GATED, S6, (position GATED).
- Set DC OFFSET IN 50 Ω, RV4, to 0 V.
- Choose the required amplitude and polarity of the output pulse with switch AMPLITUDE IN 50 Ω, S4, and vernier RV5.
- Select normal or inverted mode with switch NORM. INV., S8.
- Set switch DELAY, S2, to 5 ns and turn FINE control RV2 fully counter-clockwise.
- Apply the external gating signal from another pulse generator to input TRIGG./GATE IN, P1.
  Input amplitude > +1.2 V.
- Select the pulse width in accordance with the repetition time.
- Figure VI-7 illustrates the correct relationship between the time settings of the PM 5775 (PM 5776) and the external pulse source.

If gated double-pulse operation is required check also the conditions for double pulse mode (paragraph B.2.).

Because of internal synchronisation the PM 5775 (PM 5776) frequency and the external gating frequency are automatically locked to ensure jitter-free operation.

B.4. External triggering

- Release switch CONT. GATED, S6, (position CONT.) and SINGLE DOUBLE, S7, (position SINGLE).
- Set control DC OFFSET IN 50 Ω, RV4, to 0 V.
- Select the required amplitude and polarity using switch AMPLITUDE IN 50 Ω, S4, and vernier RV5.
- Select normal or inverted mode using switch NORM. INV., S8.
- Set the REPETITION TIME switch, S1, to position TRIGG. OR SINGLE SHOT.
- Select delay and width in accordance with the external signal.
- Apply the triggering signal to input TRIGG/GATE IN, P1.
  Input amplitude > +1.2 V, frequency d.c....50 MHz.
- At output SYNC. OUT, P2, a synchronisation signal now is available, which lags the input signal by approximately 12 ns.

B.5. Single shot operation

- Proceed as described in paragraph B.4, but do not apply an external signal.
- By depressing switch SINGLE SHOT, S5, one single pulse is obtained. Bounce-free switching is assured by internal electronic control.

SERVICE DOCUMENTATION

VII. CIRCUIT DESCRIPTION

The circuit description is based upon the type PM 5775 because the circuits used in the PM 5776 are identical to those of the PM 5775. The PM 5776 comprises two output circuits. The controls and BNC output socket of the channel B output have different annotations with respect to channel A output.

A. TIMING CIRCUIT (Fig. XIV-5)

The timing circuit consists of a variable oscillator with trigger and gate functions, a pulse delay circuit, a circuit for single or double pulse operation and a pulse width circuit. The timing circuit supplies output sync. pulses and pulses for the output circuit.
Socket TRIGG/GATE IN, P1, accepts either trigger pulses or gate signals.

A.1 Trigger circuit

Diodes Z201 and Z202 are connected as a current switch and voltage limiter.
Transistors Z203 and Z204 form a Schmitt trigger circuit.
When switch REPETITION TIME is in position TRIGG. OR SINGLE SHOT – or if switch CONT. GATED, S6, is in position GATED – Z204 is conducting and Z203 is cut off.
Then the Schmitt-trigger is switched over by the trigger or gate signal applied to socket TRIGG./GATE IN, P1.

Switch REPETITION TIME, S1, in position TRIGG. or SINGLE SHOT.

In this position switch CONT. GATED, S6, is short circuited by switch S1.
From the +5 V supply, a current will flow through R201, Z202, R203 and R204 to the –20 V supply voltage (connector 32). If a trigger signal with an amplitude exceeding +1.2 V is applied to socket TRIGG./GATE IN, P1, or when push-button SINGLE SHOT, S5, is depressed, the Schmitt-trigger switches over and positive pulses appear across collector resistor R209.

Switch REPETITION TIME, S1, in one of the time positions.

In all these positions, switch SINGLE SHOT, S5 is short circuited by switch REPETITION TIME, S1. When switch CONT. GATED, S6, is in position GATED, transistor Z203 is cut off because the cathode of diode Z202 is connected to –20 V via R203 and R204. However, a positive gate pulse supplied to socket TRIGG./GATE IN makes Z203 conductive and, consequently, the Schmitt-trigger switches over. This situation remains maintained as long as the gate pulse is present.

If switch CONT. GATED, S6, is in position CONT. the –20 V supply is switched off, so that Z203 conducts and Z204 is cut off.

2. Astable multivibrator

The oscillator is an emitter-coupled astable multivibrator consisting of transistors Z206 and Z208. The time determining elements R and C are represented by R211, R213, RV202, RV203, RV1A, C209 and C1...C9. Capacitors C1...C9 are connected in parallel with C209.
Via zener diode Z205 and resistors R212 and R284 a bias voltage of –5 V is fed to the base of Z206.
The currents through Z206 and Z208 are supplied by transistors Z207 and Z259 which may be regarded as constant current sources. The bases of Z207 and Z259 are biased to about –10 V, whereas the total current is adjustable by means of RV1B.
The frequency setting of the multivibrator is effected by switch REPETITION TIME, S1, and potentiometer RV1A. This potentiometer is incorporated in the collector circuit of Z206. This means that the amplitude of the multivibrator signal depends on the frequency. This amplitude variation, however, is reduced by potentiometer RV1B which is coupled with RV1A. When the frequency of the multivibrator is e.g. increased by a decrease of RV1A this will result in a smaller amplitude. However, the current through Z207 and Z259 will increase because the setting of RV1B is varied at the same time. The degree of this current increase is such that the amplitude variation will be eliminated.

3. Gate function

External triggering and single shot operation.

Diodes Z212 and Z213 form an AND-gate, i.e. both cathodes should be positive to affect Z215.
In position TRIGG. or SINGLE SHOT of switch REPETITION TIME, S1, transistor Z208 is cut off because its emitter is connected to earth via switch S1.
The cut-off-stage of Z208 implies a high level on the cathode of Z213 so the latter will cut off.
Then the differential amplifier Z215-Z218 can be switched over only if the voltage level on the cathode of Z212 becomes high. This voltage level becomes high by either supplying trigger pulses to socket TRIGG./GATE IN, P1, or depressing SINGLE SHOT switch S5.

Internal operation, externally gated

In this operation mode, the REPETITION TIME switch S1 occupies one of the time positions between 10 ns and 100 ms and switch CONT. GATED S6 is set to position GATED. The multivibrator is inoperative due to the high collector level of Z203.

When the gate pulse is applied, the Schmitt-trigger Z203-Z204 switches over so that the cathode level of Z212 becomes high, as long as the gate pulse is present. At the same time, Z211 will be cut off because the base bias decreases and the multivibrator starts oscillating. The output pulses of the multivibrator can then affect the differential amplifier Z215-Z216 as long as the level on the cathode of Z212 is high, so in this mode during the presence of the gate pulse.

A.4. Sync. output amplifier

Z215 and Z218 form a differential amplifier which is switched over by a positive pulse at the base of Z215 to the state Z218 conducting and Z215 cut-off. This differential amplifier is followed by a second balanced differential amplifier consisting of Z217 and Z220. In the quiescent state Z217 is conducting and Z220 cut off. Z217 supplies output sync. pulses and because Z217 is conducting when the differential amplifier is in the quiescent state, the level of the signal at socket SYNC. OUT, P1, is almost 0 V. When the differential amplifier switches over Z217 is cut off and Z220 conducts via R237 and delay line DL201. The sync. output pulse at socket SYNC. OUT will be 1.5 V into 50 Ω.

A.5. Pulse delay circuit

The pulse delay circuit is controlled by a 4 ns pulse produced in the collector of transistor Z224. Z223/Z224 forms a differential amplifier whose bases are connected to the emitter resistors R233 and R236 of the emitter followers Z222 and Z225 (Fig. VII-1).

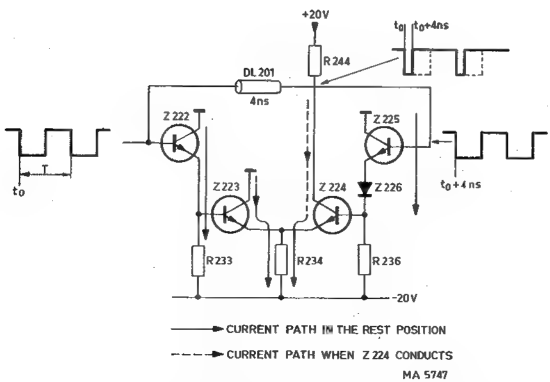


Fig. VII-1. Simplified diagram of the pulse delay trigger circuit

In the quiescent state the voltage levels at the bases of Z222 and Z225 and consequently the emitter levels are the same. Z223 is conducting and due to diode Z226, transistor Z224 is cut off. When a negative pulse coming from Z220 is injected into the base of Z222, the differential amplifier Z223/Z224 switches over (moment t_0) and the collector of Z224 goes negative.
The base signal of Z220 is also injected into the base of transistor Z225, however 4 ns later, because this pulse has to pass the delay line DL201 which has a delay time of 4 ns. As result of the emitter follower action of Z225 the negative delayed pulse turns off transistor Z224 so that in the collector of Z224 a pulse will be produced with a pulse width of 4 ns.
The 4 ns pulse is used to trigger the pulse delay timing circuit consisting of the differential amplifier Z229/Z230, emitter follower Z234, transistor Z231 and the timing capacitors C228//C12...C18 (Fig. VII-2).

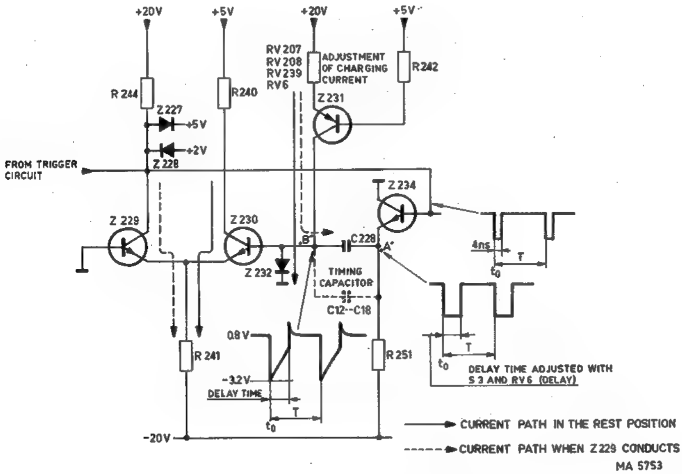


Fig. VII-2. Simplified diagram of the pulse delay circuit

The pulse is fed to the base of emitter follower Z234 through which the voltage at "A" decreases abruptly from –4 to approx. –8 V.
The voltage at "B" drops by the same amount namely from +0.8 V to approx. –3.2 V. Consequently the differential amplifier Z229/Z230 switches over and Z230 and diode Z232 will be cut off. Transistor Z234 remains cut off as result of the low collector voltage of Z229. This situation will be maintained until the timing capacitor C228 is charged to 0 V.
Timing capacitor C228, to which capacitors C12...C18 can be connected in parallel by means of switch DELAY, S2, is charged by the collector current of transistor Z231, which acts as a constant current source. The charge current is adjustable by means of the potentiometers RV207, RV208 and DELAY, RV2.

The voltage level at "B" increases linearly, and when it reaches the zero level, transistor Z230 starts conducting and the differential amplifier switches back to its initial state.
The collector voltage of Z229 changes then from +2 V to +6 V so that Z234 will conduct again.
The timing capacitors will now be discharged via diode Z232 because the collector current supplied by Z231 is forced to flow through Z232 to earth.

From the foregoing it follows that the width of the "delay pulse" at the emitter of Z234 depends on the value of the charging current and the values of the timing capacitors C228//C12...C18.
Transistor Z221 and diodes Z227 and Z228 form a clipping circuit that limits the collector voltages of Z224 and Z229 between approx. +6 V and +2 V.

A.6. Single and double pulse operation

Transistors Z235 and Z236 form a differential amplifier from which transistor Z235 is conducting in the quiescent state. The base of Z236 is kept at a reference voltage level which is adjustable with potentiometer RV209 (Fig. VII-3).

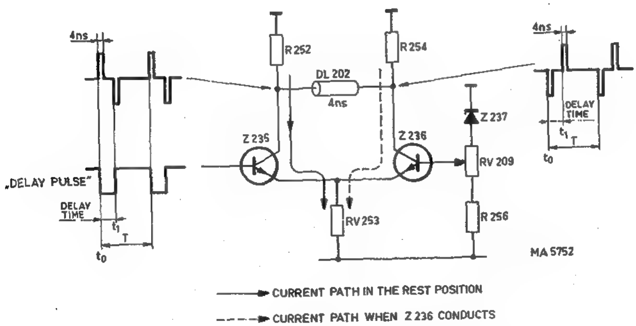


Fig. VII-3. Simplified diagram of the pulse width trigger circuit

When the negative going "delay pulse" coming from the emitter of Z234 exceeds the reference voltage level, the differential amplifier switches over.
Consequently, a positive-going voltage stap arises at the collector of Z235 and at the same time a negative-going step at the collector of Z236 (moment t_0).
The positive voltage step is transmitted through the delay line DL202 to the right and reaches the end after a delay time of 4 ns.

The positive voltage step cancels out the negative going voltage step at the collector of Z236 so that there a negative-going pulse arises with a width of 4 ns.
In the same way the negative-going voltage step at the collector of Z236 cancels out the positive-going step at the collector of Z235.
This results in a positive-going pulse, with a width of 4 ns on the collector of Z235.

At moment t_1, the differential amplifier Z235/Z236 switches over to its initial state and the same procedure described above is repeated, however in the reverse direction. The result is now that a negative-going and positive-going pulse appears at the collector of Z235 and Z236 respectively.
The pulse are fed to differential amplifiers Z240/Z245 and Z241/Z244 via emitter followers Z238 and Z246 respectively.
When switch SINGLE/DOUBLE, S7, is in position SINGLE, the differential amplifier Z241/Z244 is inoperative because emitter resistor R259 is connected to earth. In the quiescent state, transistor Z240 is conducting and Z245 cut off.
When a positive pulse is injected into the base of Z240 and a negative pulse into the base of Z245, the differential amplifier will remain in its initial state. These pulses are present at the moment t_0 as can be seen in the diagram of Fig. VII-3 so at the beginning of the pulse delay time.
When, however, at the same time a negative and a positive pulse – which are formed at the end of the delay time – are simultaneously injected into the bases of Z240 and Z245 respectively, the differential amplifier Z240/Z245 switches over and a negative pulse arises in the collector circuit of Z245. This pulse is taken from the collector of Z243 and further fed to the pulse width circuit.
When switch SINGLE/DOUBLE, S7, is in position DOUBLE, the differential amplifier Z241/Z244 is in operation. In the quiescent state Z241 is cut off and Z244 is conducting. The differential amplifier switches over when at the same time a positive and a negative pulse is injected into the bases of Z241 and Z244 respectively. As can be seen in Fig. VII-3, these pulses are present at the start of the delay time.
The resulting negative pulse is also taken from the collector of Z243.
Resuming one can say that negative trigger pulses are produced by the differential amplifiers Z240/Z245 and Z241/Z244.
With switch SINGLE/DOUBLE, S7, in position DOUBLE, two negative pulses are generated whose time interval between the negative-going edges equals the delay time which is adjustable with switch DELAY, S2, and fine delay control RV2.

7. Pulse width circuit

The operation principle of the pulse width circuit (Z250/Z251, Z255, Z252 and timing capacitors C229//C22...C28) is exactly the same as that of the pulse delay circuit.
Transistor Z242 and diodes Z248 and Z249 form the clipping circuit. The pulse width is adjustable both in steps and continuously by means of switch WIDTH, S3, and potentiometer RV3 respectively.
The differential amplifier Z256/Z257 is controlled by the negative trigger pulses coming from the emitter of Z255. In order to enable normal or inverted pulse operation there should be positive or negative pulses.

By means of switch NORM. INV., S8, positive and negative pulses can be taken from the collectors of Z256 and Z257 respectively.
The selected pulses are fed to the output circuit.

B. OUTPUT CIRCUIT AND D.C. OFFSET (Fig. XIV-8)

B.1. Differential amplifiers

The pulses produced by the timing circuit pass through phase inverter switch NORM./INV., S8, one section of switch AMPLITUDE IN 50 Ω, S4, and zeners Z301 and Z305 to the bases of differential amplifier Z302-Z303. This amplifier is the first link in a chain of six similar ones.
In the operating mode illustrated in the circuit diagram (Fig. XIV-8), i.e. switch S8 set to NORM. and switch S4 to −3 V, the positive-going pulse at connector 53 on printed-wiring board 2 is applied to the base of Z303.
The signal path to the last amplifier stage goes through Z303, Z306, Z310, Z312, Z313, Z320, Z319 and Z321.
The pulse is negative-going at the base of Z322 and this transistor is cut off. Simultaneously and similarly, the negative-going pulse at connector 54 on printed-wiring board 2 goes through the second branch of the differential amplifiers to the base of Z323. Here, this pulse is positive-going and can pass the transistor to the input of the driver Z329 via zener diode Z325.

B.2. Driver and output stage

Refer to the simplified diagram Fig. VII-4 and the detailed circuit diagram Fig. XIV-8
The driver consists of differential amplifier Z329-Z330 and constant current source Z326-Z327.
Before moment t_1, Z329 is off and Z330 is on. The current source Z326-Z327 supplies current I_2 through Z330. A small portion i of I_2 is diverted to clipping diode Z333, but the major portion $I_2 - i$ flows through Z334 – Z335.
Output transistor Z332 is connected in the common-base configuration, and its base voltage is held at a constant level by transistor Z336.
Before moment t_1, Z332 is off, which means 0 volts across load resistor R_L.
At moment t_1, the negative step at the base of Z329 will switch the differential amplifier so that current I_2 flows through Z329. Z330 is cut off so that output transistor Z332 turns on and current I_1 flows through Z334-Z335. The voltage across load resistor R_L drops to a value determined by current I_1.
At moment t_2, the state before t_1 re-appears.

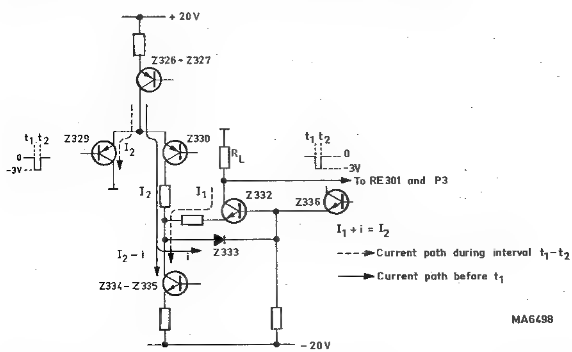


Fig. VII-4. Simplified diagram of the driver and output stage

In simplified diagram of Fig. VII-5 the amplitude fine control circuit is added. By turning FINE control RV5, current I_3 through Z342 is changed. For example, if I_3 decreases, the base voltage of Z334-Z335 will also decrease.

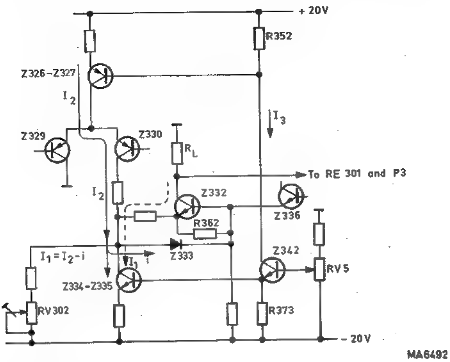


Fig. VII-5. Simplified diagram of the driver and output stage with fine control circuit

Z334-Z335 conduct less and the decreased-current I_1 results in a lower voltage drop across load resistor R_L.
Simultaneously, current I_2 is decreased proportionally by the increased base bias of Z326-Z327 across R352, through which I_3 is also flowing.

To improve the switching properties of output transistor Z332 resistor R362 is incorporated between base and emitter. Then the emitter current I_1 must have a certain value to get a voltage across R362 exceeding the base-emitter voltage of Z332 before it can pass the transistor. The small base line shift thus obtained is counteracted by a current through preset potentiometer RV302 with which the zero level of a positive pulse is set.

B.3. Current source, positive pulse out

Fig. VII-6 is a simplified diagram showing the principal function of this circuit.

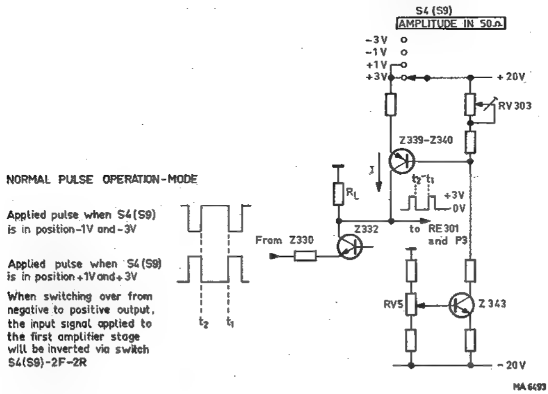


Fig. VII-6. Simplified diagram of the current source for the positive output pulse

When switch AMPLITUDE IN 50 Ω, S4, is set to positions +1 V or +3 V, the +20 V supply is connected to the emitters of transistors Z339-Z340. A positive current I then flows through the transistors to the output at the collector of Z332. This current will shift the base line in positive direction.
Section 2F-2R of switch S4 at the input of the differential amplifiers (see detailed circuit diagram Fig. XIV-8) inverts the pulses so that a positive pulse is obtained at the output.
FINE amplitude potentiometer RV5 controls current I via Z343. Correct zero level of the positive pulse is set with potentiometer RV303.

B.4. Attenuator

The attenuator consists of a resistive T network R381...R386 which loads the output of Z332 through two reed relays RE301 and RE302. The network is only connected in the −1 V and +1 V positions of switch AMPLITUDE IN 50 Ω, S4. At these settings the +20 V supply is connected to the reed relay coils L320 and L321 which then energize the reed relays so that the attenuating network is connected to the output line.

B.5. DC Offset

Base line shift of 1.5 V both in positive and negative direction is provided by adding a positive or a negative current to the output pulse.
The positive current is supplied by transistors Z344 and Z345 which are controlled by potentiometer DC OFFSET IN 50 Ω, RV4A. Similarly, the negative current is supplied by transistors Z346 and Z347 which are controlled by potentiometer RV4B.

POWER SUPPLY (Fig. XIV-2)

From socket P4 the mains voltage is applied to the primary winding of mains transformer T1, via mains switch S11 and voltage adapter S12. The voltage adapter has two positions: 115 V and 230 V (± 15 %).
The secondary winding of T1 has a centre tapping which is connected to earth, and full-wave rectification is obtained by means of diode bridge Z3. The voltages on points 6 and 3 are +32 V and –30 V respectively.
The voltage on point 6 is fed to the collector of a series regulator transistor Z1 by means of which the stabilised +20 V is obtained.
The stabiliser circuit consists of zener diode Z110, resistor R108, transistor Z109 and resistors R109, RV101 and R110.
Across the zener diode a reference voltage appears which is fed to the emitter of Z109. The base of Z109 is connected to a voltage divider, and the voltage at the collector will consequently change in accordance with the change of the +20 V output voltage. The collector of Z109 is connected to the base of driver transistor Z101. Z101 is an emitter-follower, whose emitter is connected to the base of regulator transistor Z1. In this way the +20 V output voltage is stabilised.
C101 and C105 are filter capacitors. R101 is connected in the collector circuit of Z101 in order to limit the current through the transistor in case the +20 V would be short-circuited.
The stabilising circuit for the –20 V output voltage is almost equal to the circuit described above. However, because the same type of regulator transistor (Z2) is used – i.e. NPN-type - the zener diode is connected between +20 V and –20 V.
Apart from the two voltages +20 V and –20 V a voltage of +5 V is available.
The +5 V is obtained from the sum of the voltage across Z119 (4.3 V) and the base-emitter voltage of Z111 (0.7 V). If the +5 V voltage changes the base-emitter voltage of Z111 will change, and the current through Z111 will also change.

Because the collector of Z111 is connected to the base of Z112 the voltage of +5 V will be regulated to its initial value. The regulation can only be effected within a certain limited range because part of the current through the voltage divider also flows through resistor R116 which is connected in parallel with Z112.
By this arrangement transistor Z112 is protected against overload.

VIII. GAINING ACCESS TO AND REPLACING OF PARTS

A. REMOVING THE CABINET

1. Removing the left-hand and right-hand side plates
   - Loosen the screws of the handle.
   - Remove the handle.
   - Pull out the side plates in backward direction.
2. Removing the cover plate and bottom plate
   - Loosen the screws at the rear.
   - Pull out the plates in backward direction.
   - When refitting the bottom plate it should be observed that the notch in the bottom plate is slipped underneath the fitting assy.
3. Removing the tilting assembly.
   - Move the small outermost nylon slides "A" inward (Fig. VIII-1).
   - Remove the tilting assembly.

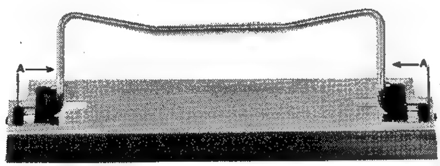


Fig. VIII-1. Tilting assembly

B. REMOVING THE KNOBS (Fig. VIII-2)

- Remove knob cap A.
- Loosen nut B.
  The knob can now be pulled off the spindle.
- At switching knobs, loosen nut C.
  For releasing the clamping cone, tap the spindle carefully in the axial direction while holding the knob.

When fitting the knobs ensure that the marks have the same position as before removal.

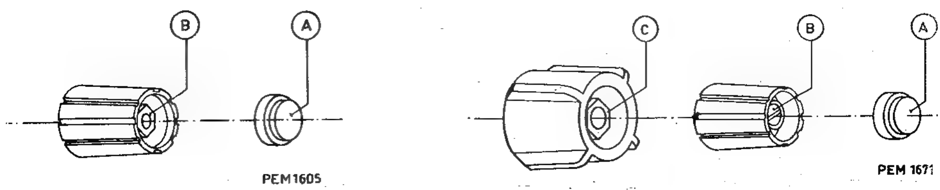


Fig. VIII-2. Removing the knobs

REMOVING LAMP LA1 IN THE POWER ON SWITCH

- Turn the instrument upside down.
- Remove the transparent cap from the button by inserting a screwdriver as shown in Fig. VIII-3 and gently twisting it.
- Pull out the lamp by means of tweezers.
  The removal is facilitated if the tweezers are provided with double-adhesive tape.

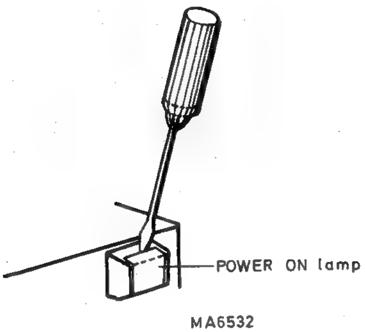


Fig. VIII-3. Removing the transparent cap of the POWER ON switch

REMOVING CIRCUIT BOARD 3 (Fig. VIII-4)

- Remove the two coaxial cables from the connectors on the soldering side.
- Loosen the two screws "B".
- Loosen nut "A" at the output connector P3, and pull out the coaxial cable.
- Pull up the board.

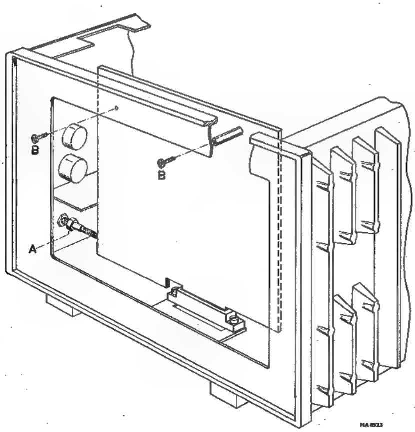


Fig. VIII-4. Removing the output unit (printed wiring board PM 5775-3)

E. REPLACING REED RELAYS RE301 and RE302 (Fig. VIII-5)

- Carefully pull off the plastic cover by compressing the sides.
- Unsolder the relay connections.
- Remove the coil with tube from the printed wiring board.
- Withdraw the tube containing the reed relay from the coil.
- Fit a new reed relay.

Important: *Most of the coils are marked at one end with a red dot.*
When mounting the reed relay, ensure that the side with one lead, is directed to the marked end of the coil.

- Install the relay in reverse order to that stated above.

Note: – *Do not forget to solder the earth connections.*
– *The distance between the underside of resistor R359 and the printed wiring board should be at least 3 mm.*

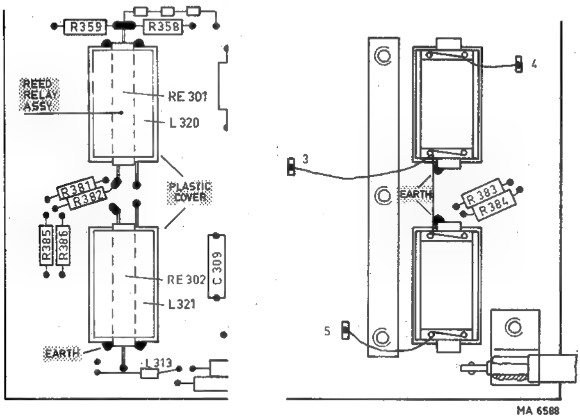


Fig. VIII-5. Removing reed-relay coils L320, L321

'. REPLACING TRANSISTOR Z330

Between transistor Z330 and the printed wiring board a beryllium oxide (BeO) heat sink disc is mounted.
To improve the thermal conductivity of this disc, a special silicone heat sink compound (Midland Silicones Ltd., Type MS 2623) should be applied at both sides of the disc.

Note 1: **Beryllium oxide dust is dangerous to inhale. Do not grind the discs.**

Note 2: **The silicone compound should not be applied at soldering points or the transistor leads since this make soldering impossible.**

Proceed as follows:

- Remove the faulty transistor. Clean the old Be0 heat sink disc and, if necessary, the printed wiring board with isopropyl alcohol.
- Mount the disc on the leads of the new transistor and hold it between your thumb and forefinger as shown in Fig. VIII-6a.
  Apply a thin coating of the silicone compound on the transistor bottom by means of a piece of wire which is flattened in one end. Do not overdose.
- Press the disc firmly against the transistor and apply a thin coating of the silicone compound on the heat sink disc (Fig. VIII-6b).
- Mount the transistor tight to the printed wiring board (Fig. VIII-6c). Ensure that the soldering is proper by bending the transistor slightly from side to side. An overdose of the silicone compound may cause bad soldering.

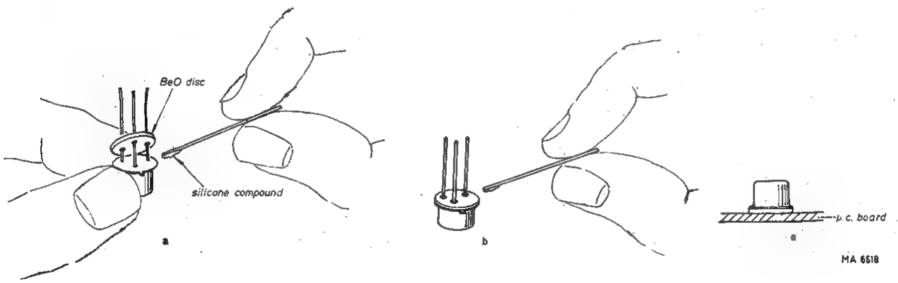


Fig. VIII-6. Applying of the silicone compound

G. REPLACING CERAMIC CHIP CAPACITORS C305, C306, C307

These ceramic chip capacitors are silver end terminated. Using ordinary 60/40 Sn/Pb solder may cause leaching of the silver into the solder resulting in loss of bond strength. Therefore, a silver bearing solder should be used, e.g. 62 % tin, 36 % lead and 2 % silver.

The following points should be noted when replacing a chip capacitor:

- The silver end terminations may leach into the solder if they are immersed in molten solder for too long a period of time. Remember that soldering iron temperatures are often well above the melting point of the solder.
- Corners and edges may be chipped if capacitors are roughly handled with metal tweezers. To avoid chipping, use plastic tweezers.

X. SURVEY OF ADJUSTING ELEMENTS AND TEST INSTRUMENTS REQUIRED

EST INSTRUMENTS

igital multimeter ange 20 V d.c. (1 %); 100 mA d.c. (5 %)	e.g. PHILIPS PM 2421 or PM 2422
ulse generator xternal trigger facility required input trigger signal: + 1.2 V ulse width adjustment 200 ns	e.g. PHILIPS PM 5770 or PM 5775/76
ounter/timer uitable for period and pulse width measurements ime resolution: 10 ns	e.g. PHILIPS PM 6630
ampling oscilloscope	e.g. PHILIPS PM 3400
athode follower probe	e.g. PHILIPS PM 9345
et of attenuator heads	e.g. PHILIPS PM 9341
50 Ω coaxial cables provided with General Radio onnectors *	e.g. General Radio GR CO 874 R20A
) dB Attenuator provided with BNC connectors	e.g. Texscan BNC outline AFP50
) dB Attenuator	e.g. General Radio GR874 – G20
Adapters General Radio plug to BNC socket	e.g. PHILIPS PM 9064 or General Radio GR874 QBPA
BNC T-connector UG-274/U	e.g. PHILIPS PM 9067
50 Ω Termination, 3 W	e.g. PHILIPS PM 9581

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nstead of these cables also 50 Ω coaxial cables, type RG58A-U, provided with BNC connectors
ay be used.
t the Central Service dpt. the following coaxial cables can be ordered:

ength (mm)	Delay (ns)	Service code nr.
200	1	5322 320 10009
400	2	5322 320 10011
600	3	5322 320 10012
980	10	5322 320 10013

ADJUSTING ELEMENTS

Adjustment	*Adjusting element*	*Section of chapter X*
A. Power supply		
+20 V	RV101	A.1
−20 V	RV102	A.1
B. Timing circuit		
Gate function	RV204, RV205, RV206	B.1
Astable multivibrator	RV202, RV203	B.2
Delay	RV207, RV208	B.3
Width	RV209, RV210, RV211	B.4
Delay (5 ns)	RV209	B.5
Width (5 ns)	RV212	B.6
C. Output circuit and d.c. offset		
Bias transistor Z330	RV301	C.1
Zero level positive pulse	RV302, RV303	C.2
D.C. offset		C.3
+1.5 V	RV305	
−1.5 V	RV304	

X. CHECKING AND ADJUSTING

The tolerances mentioned are factory tolerances; they apply when the instrument is readjusted completely.
They may differ from the data given in chapter II.
A summary of adjusting elements is given in chapter IX.

A. POWER SUPPLY

Adjustments should be carried out after a warming up time of approx. 30 min.

A.1. Power supply

- Set switch AMPLITUDE IN 50 Ω, S4, to position negative (–).
- Check by means of a d.c.-voltmeter the +20 V and –20 V d.c. voltages (points 10 and 13 respectively on printed-wiring board 1) at nominal mains voltage.
  Permissible tolerance ± 1 %.
  If necessary, adjust with RV101 and RV102 respectively.

B. TIMING CIRCUIT

B.1. Gate

For checking and adjusting of the gate-function, an auxiliary pulse generator is required which is triggered externally by the trigger output signal of the sampling oscilloscope. For this PM 5770 or PM 5775/76 may be used.

- Arrange the measuring set-up shown in Fig. X-1.
- Set the control of the instruments as follows:

Auxiliary pulse generator PM 5775 (PM 5776)

REPETITION TIME, S1	TRIGG. or SINGLE SHOT
DELAY, S2, RV2	20 ns
WIDTH, S3, RV3	200 ns
CONT. GATED, S6	CONT.
SINGLE DOUBLE, S7	SINGLE
NORM. INV., S8	NORM.
DC OFFSET IN 50 Ω, RV4	0 V
AMPLITUDE IN 50 Ω, S4, RV5	+1.2 V

Auxiliary pulse generator PM 5770

REPETITION TIME	EXT.
DELAY	20 ns
WIDTH	200 ns
PULSE MODE	CONT, SINGLE
POLARITY	NORM, positive (+)
RAMP RANGE	< 4 – 50 ns
RISE TIME	fully counter-clockwise
FALL TIME	fully counter-clockwise
DC-OFFSET	0 V
AMPLITUDE	1.2 V

Sampling oscilloscope PM 3400

TIME SCALE MAGN.	1
TIME/cm	10 ns
TRIGG./SENSITIVITY	SYNC.

Pulse generator to be tested PM 5775 (PM 5776)

REPETITION TIME, S1	10 ns
DELAY, S2, RV2	5 ns
WIDTH, S3, RV3	5 ns
AMPLITUDE IN 50 Ω, S4, RV5	+1 V
DC OFFSET IN 50 Ω, RV4	0 V
CONT. GATED, S6	GATED
SINGLE DOUBLE, S7	SINGLE
NORM. INV., S8	NORM.

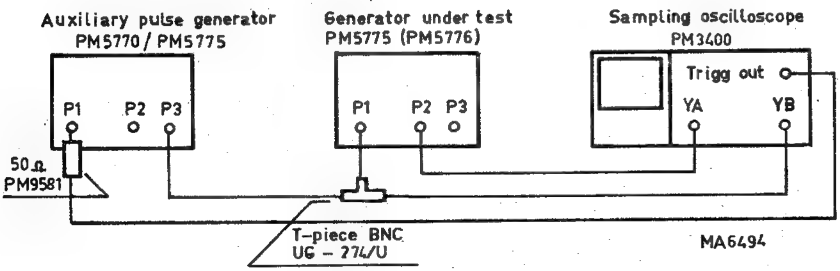


Fig. X-1. Set-up for checking the gate circuit

- Check that a pulse train appears during the gate pulse.
  If not, adjust RV205.
- Check that the pulse width and time interval between the pulses are equal.
  If necessary adjust RV204.
- Readjust RV205 so that the first pulse of the pulse train is as much as possible equal to the other pulses of the pulse train.
- Turn REPETITION TIME, RV1, fully clockwise and set TIME/cm control of the oscilloscope to 20 ns/cm.
- Check that the pulse width and time interval between the pulses are equal.
  If necessary, adjust RV206.
  The width of the first pulse may be greater than that of the other pulses with control REPETITION TIME, S1, in position 10 ns.

.2. Astable multivibrator

- Connect the pulse generator PM 5775 (PM 5776) to a counter and an oscilloscope as shown in Fig. X-2.

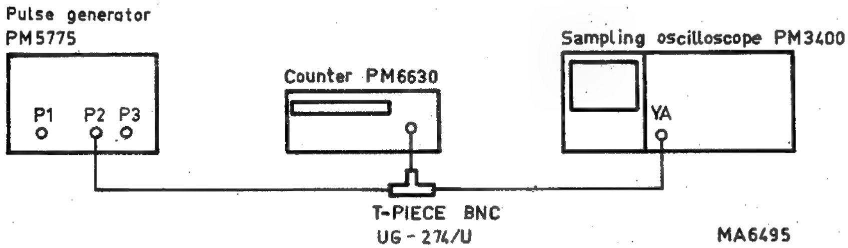


Fig. X-2. Set-up for checking the astable multivibrator.

- Change the control settings of the pulse generator as follows:
  REPETITION TIME, S1 — 10 μs
  REPETITION TIME FINE, RV1 — fully counter-clockwise
- Set the time-base-control of the counter to a position which gives an accurate 9 μs read out.
- Set the oscilloscope to 1 μs/cm.
- Check that the repetition time is 9 μs ± 3 %.
  If necessary, adjust RV203.
- Turn vernier REPETITION TIME, RV1, fully clockwise.
- Check that the repetition time is 110 μs ± 3 %.
  If necessary, adjust RV202.

B.3. Delay

- Set the controls of the pulse generator as follows:

REPETITION TIME, S1	0.5 s
DELAY, S2	10 μs
DELAY FINE, RV2	fully counter-clockwise
WIDTH, S3	1 μs
WIDTH FINE, RV3	fully counter-clockwise
SINGLE-DOUBLE, S7	DOUBLE

- Check that the delay time is 9 μs ± 3 %.
  If necessary, adjust RV208.
- Turn vernier DELAY, RV2 fully clockwise.
- Check that the delay time is 110 μs ± 3 %.
  If necessary, adjust RV207.

B.4. Width

- Connect an oscilloscope to the emitter of Z255 (R278) via a probe with at least 5 kΩ input impedance.
- Check that a pulse appears. If necessary adjust RV209.
- Connect the instruments as shown in Fig. X-2.
- Set the controls of the pulse generator as follows:

REPETITION TIME, S1	500 μs
DELAY, S2	5 ns
WIDTH, S3	10 μs
WIDTH FINE, RV3	fully counter-clockwise
SINGLE DOUBLE, S7	SINGLE

- Set the timebase-control of the counter to a position which gives an accurate 9 μs read out.
- Check that the pulse width is 9 μs ± 3 %.
  If not, adjust RV211.
- Set vernier WIDTH, RV3, fully clockwise.
- Check that the pulse width is 110 μs ± 3 %.
  If not, adjust RV210.

B.5. Delay, 5 ns adjustment

- Set the controls of the pulse generator as follows:

REPETITION TIME, S1	150 ns
WIDTH, S3	5 ns
WIDTH FINE, RV3	fully counter-clockwise
DELAY, S2	5 ns
DELAY FINE, RV2	fully counter-clockwise
SINGLE DOUBLE, S7	SINGLE

- Connect an oscilloscope to the emitter of Z255 (R278) via a probe with at least 5 kΩ input impedance.
  The oscilloscope should be triggered by the sync. pulse which is available on socket SYNC. OUT, P2, of the pulse generator.

- Observe the position of the pulse on the screen (Fig. X-3a).
  Adjust vernier DELAY, RV2, until the pulse is delayed additionally 5 ns (i.e. 10 ns in total, Fig. X-3b).
- Set SINLGE DOUBLE, S7 to position DOUBLE.
  By means of RV209 adjust the delay between the pulses to 10 ns (Fig. X-3c).

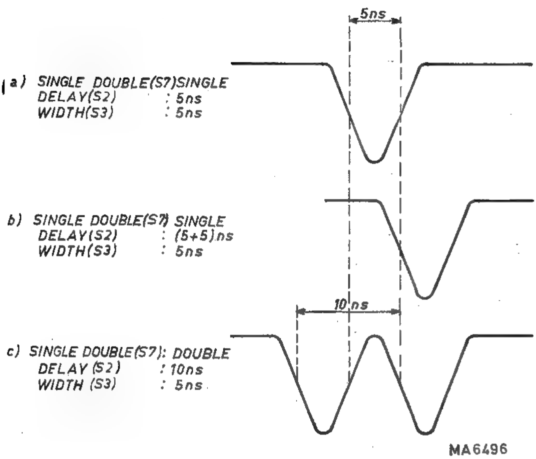


Fig. X-3. Pulse diagram for 5 ns delay adjustment

Width, 5 ns adjustment

- Set switch SINGLE DOUBLE, S7, to position SINGLE.
- Connect the oscilloscope via a probe with an input impedance of at least 5 kΩ to pin 4 of switch NORM. INV., S8.
- Adjust RV212 until the pulse width amounts to 5 ns.
- Depress NORM. INV. switch S8 and check that the inverted pulse also has a pulse width of 5 ns.

C. OUTPUT CIRCUIT AND DC OFFSET

Preliminary settings of controls:

PM 5775 (PM 5776)

REPETITION TIME, S1	10 μs
FINE, RV1	12 o'clock
DELAY, S2	100 ns
FINE, RV2	fully counter-clockwise
WIDTH, S3	1 μs
FINE, RV3	fully counter-clockwise
CONT. GATED, S6	CONT
SINGLE DOUBLE, S7	SINGLE
AMPLITUDE IN 50 Ω, S4	–3 V
Vernier, RV5	MAX.
DC OFFSET IN 50 Ω, RV4	0 V
NORM. INV., S8	INV.

PM 3400

mV/cm	50, CAL
TIME/cm	2 μs

Connect socket PULSE OUT 50 Ω, P3, to one of the oscilloscope inputs via a 50 Ω coaxial cable and a 20 dB attenuator (e.g. General Radio GR874 G20). Connect socket SYNC. OUT, P2, to the TRIGG. input of the oscilloscope via a 50 Ω coaxial cable and a 20 dB attenuator (e.g. Texscan type FP 50, BNC Outline A).

C.1. Bias Z330

– Observe a flat pulse top on the oscilloscope screen. If required, adjust with RV301. Fig. X-4 shows unacceptable deviation.

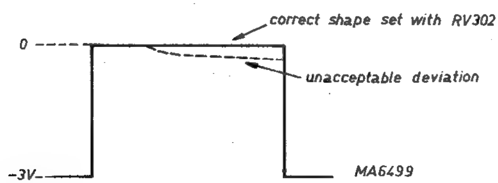


Fig. X-4. Pulse diagram

2. Zero level, positive pulse

Change the previous settings of the pulse generator as follows:

AMPLITUDE IN 50 Ω, S4	+3 V
Vernier, RV5	MAX.
NORM. INV., S8	NORM.

Set the TIME/cm switch of the oscilloscope to 1 μs/cm.

Requirement:

When turning vernier RV5 from one extreme position to the other, the base line of the pulse may not shift more than ± 25 mV **symmetrically** around the zero level.

- Turn RV5.
- Coarsely adjust the deviation amplitude with RV302 (do not care about the symmetry yet).
- Set the oscilloscope input sentitivity to 5 mV/cm and check the adjustment by turning vernier RV5. Readjust if required.
- Remove the signal from the oscilloscope and note the position of the zero level. Reconnect the signal.
- If required, adjust RV303 so that the base line of the pulse coincides approximately with the zero level.
- Centre the zero line.
- Turn vernier RV5 again and check the symmetry of the base line shift. Readjust, if necessary, with RV303.
- Alternate between RV302 and RV303 until a base-line shift of ± 25 mV symmetrically around the zero level is obtained.
- Finally, repeat the procedure from point C.1.

3. Pulse shape adjustment

Set the pulse generator and oscilloscope as detailed in point C except the following:

Pulse generator

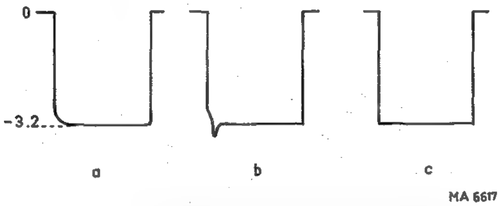
REPETITION TIME	1 μs
DELAY	5 ns
WIDTH	5 ns
WIDTH FINE	fully clockwise
NORM./INV.	NORM.

Oscilloscope

TIME/cm	5 ns

- If an overshoot or rounding is visible on the leading edge of the pulse, adjust RV306 until the overshoot or rounding has vanished. See Fig. X-5.
- Switch to the INVERTED mode and check that no rounding has occured on the trailing edge.

- If necessary readjust RV306.
  Sometimes it may be necessary to make a compromise between the pulse shapes in the NORMAL and INVERTED mode.
- Turn the AMPLITUDE FINE control, RV5, to MAX.
- Check that the amplitude is 3.2 V ±0.1 V (applies to an instrument which has been switched on for at least 30 minutes).
- Readjust, if necessary, by replacing resistor R1 across potentiometer RV5 with another value. The value may vary between 6 kΩ and 12 kΩ.



Fig's a and b show possible deviations (exaggerated) before adjustment
Fig. c shows correct shape (idealised) after adjustment.

Fig. X-5. Pulse diagram

Waveform distortion

Distortion may be observed on the output pulse when the instrument is set as follows:

S4 (S9)	AMPLITUDE	+3 V
RV5 (RV7)	Vernier	MAX. (fully clockwise)
RV4 (RV6)	DC OFFSET	+1.5 V (fully clockwise)
S3	WIDTH	100 ns
S8 (S10)	NORM/INV.	NORMAL

At these settings transistors Z339 and Z340 will be saturated and, depending on their saturation properties, cause distortion. See figure below.

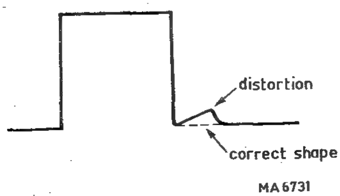


Fig. X-6. Pulse diagram

The malfunction is remedied by changing the value of resistors R377 and R378 from 220 Ω to 180 Ω. After replacement, trimmer RV303 (Zero level) should be re-adjusted as detailed in point C.2.
The resistors have already been changed in version -/02 of PM 5775 and the major part of version -/02 of PM 5776.

4. DC offset

Set the pulse generator controls as follows:

REPETITION TIME, S1	TRIGG. or SINGLE SHOT (no signal in)
NORM. INV., S8	NORM.
AMPLITUDE IN 50 Ω, S4	+3 V
DC OFFSET IN 50 Ω, RV4	+1.5 V (resp. –1.5 V)

- Connect the mA-meter to socket PULSE OUT, 50 Ω, P3.
- Read 63 mA ± 5 % on the meter, + and – with control DC OFFSET IN 50 Ω turned fully clockwise and fully counter-clockwise resp.
  If necessary, adjust with RV305 (+) and/or RV304 (–).

Shipment of the instrument

Remark

In case of breakdowns one can always apply to the world-wide PHILIPS Service Organisation.

Whenever it is desired to send the instrument to a PHILIPS Service Centre for repair, the following points should be observed:

- tie on a label, bearing full name and address of the sender.
- indicate as complete as possible the symptoms of the faults.
- carefully pack the instrument in the original packing, if still available.
- send the instrument to the address provided by your local PHILIPS representative.

XI. PARTS LISTS

A. MECHANICAL

Fig.	Item	Qty. PM 5775	Qty. PM 5776	Ordering number	Description
XI-2	1	4	4	5322 460 50101	Foot
XI-2	2	4	4	5322 462 40157	Rubber cap for foot
XI-2	3	4	4	5322 502 10015	Grub screw M3x8 (in foot)
XI-1	4	2	2	5322 460 60014	Ornamental surround
XI-3	5	2	2	5322 520 10182	Bearing for bracket
XI-3	6	2	2	5322 462 70366	Slide cam
XI-3	7	2	2	5322 460 60017	Ornamental strip (6-module length)
XI-1	8	2	2	5322 310 10044	Screw for handle bar
XI-1	9	2	2		Handle bracket
XI-1	10	2	2		Handle screw
XI-1	11	2	2		Washer for handle screw
XI-1	12	–	1	5322 498 50099	Handle grip for PM 5776 (4-module length)
		1	–	5322 498 50098	Handle grip for PM 5775 (3-module length)
XI-1	13	4	5	5322 413 30082	Knob, dia 14.5 mm
XI-1	14	4	5	5322 413 70038	Cap for knob, dia. 14.5 mm
XI-1	15	4	5	5322 413 40112	Knob, dia. 23 mm
XI-1	16	3	3	5322 413 70037	Cap for knob, dia 23 mm
XI-1	17	1	2	5322 413 30085	Knob dia 14.5 mm
XI-1	18	1	2	5322 413 70039	Cap for knob dia. 14.5 mm
XI-1	19	1	1	5322 273 50092	Switch S1
XI-1	20	2	2	5322 273 40207	Switch S2, S3
XI-1	21	1	2	5322 273 44003	Switch S4 (S9)
XI-1	22	3	4	5322 276 10366	Push button switch, S6, S7, S8 (S10)
XI-1	23	1	1	5322 276 10259	Push button switch, S5
XI-1	24	1	1	5322 276 14024	Mains switch, S11
XI-1	25	1	1	5322 134 44016	Lamp in mains switch LA1, 24-30 V, 30 mA
XI-1	26	2	2	5322 267 10004	BNC connector UG 1094-U, P1, P2
XI-1	27	1	2	5322 267 14004	BNC connector, KINGS KC-19-161, P3 (P6)
		1	2	5322 320 14002	Coaxial cable with contact pin fitting into BNC connector P3
XI-1	28	–	1	5322 455 74005	Text plate PM 5776
XI-1	–	1	–	5322 455 74004	Text plate PM 5775
XI-1	29	–	1	5322 455 74006	Text plate PM 5776
XI-2	30	2	2	5322 255 40091	Protection cap for power transistors
XI-2	31	1	1	5322 265 30066	Mains input socket, P4
XI-2	32	1	1	5322 290 40012	Earth terminal, P5
XI-2	33	1	1	5322 277 20014	Mains voltage selector, S12
XI-4	34	1	2	5322 532 60565	Nylon ring for potentiometer RV4, RV6
		47	58	5322 255 40089	Transistor holder, TO18
		17	29	5322 255 40015	Transistor holder, TO5

Fig.	Item	Qty. PM 5775	Qty. PM 5776	Ordering number	Description
		6	12	5322 255 40054	Transistor cooling fin, TO5
		2	2	5322 255 40085	Transistor holder for Z1, Z2
		4	4	5322 255 40972	Mica washer for Z1, Z2 (PHILIPS 56201d)
		2	2	5322 255 40972	Bushing for Z1, Z2 (PHILIPS 56201c)
		1	2	5322 267 50096	Connector 10-pole, P301
		–	–	5322 321 10071	Mains cable with plug and socket
		1	2	5322 255 44028	Heat sink disc (BeO) for Z 330
				5322 390 20019	Silicone heat sink compound (tube containing 4 oz)

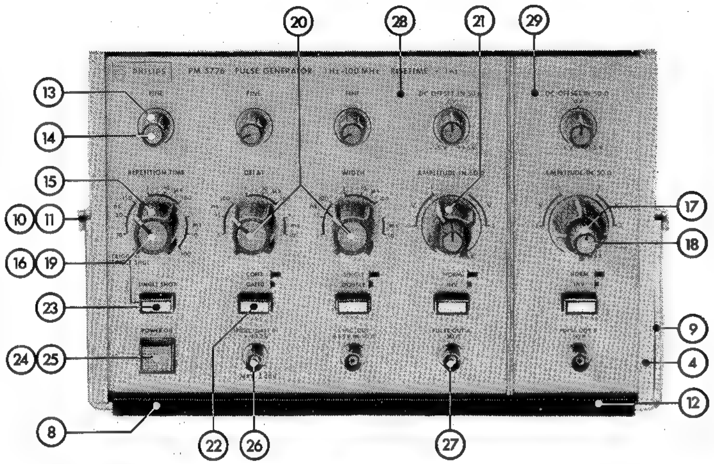


Fig. XI-1. Location of components (front)

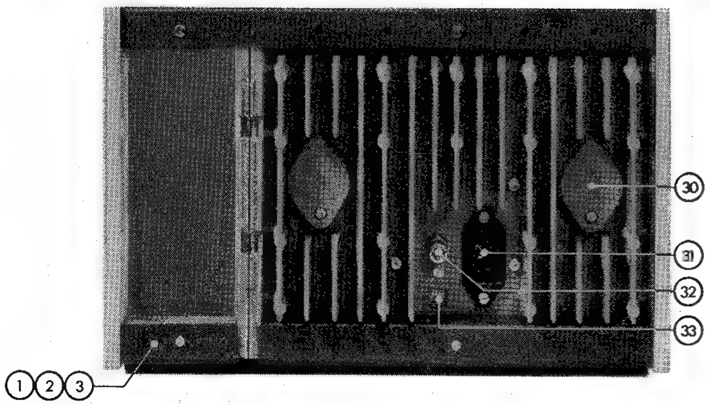


Fig. XI-2. Location of components (rear)

Fig. XI-3. Tilting assembly

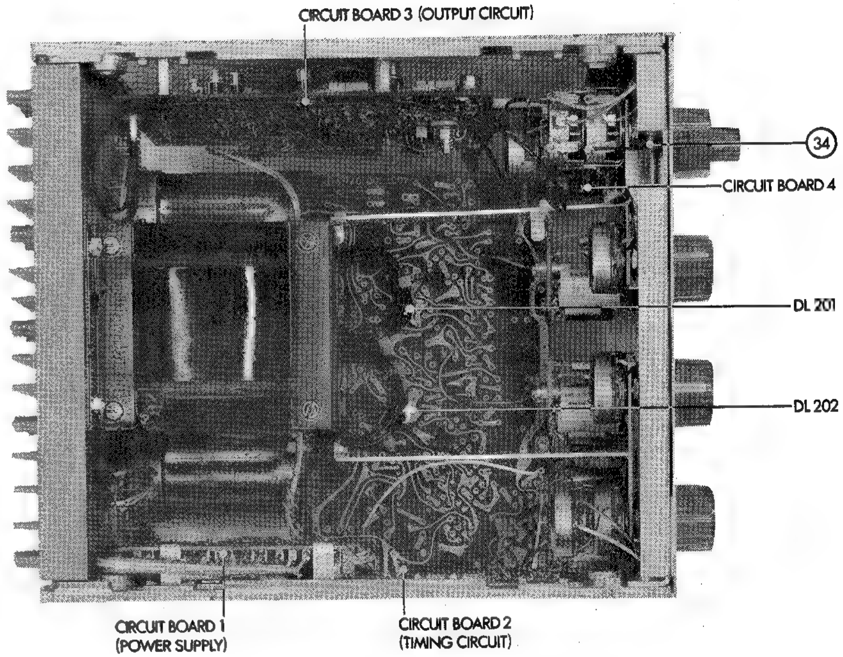


Fig. XI-4. Location of components (interieur)

B. ELECTRICAL — ELEKTRISCH — ELEKTRISCH — ELECTRIQUE — ELECTRICOS

This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.

Carbon resistor E24 series Kohleschichtwiderstand, Reihe E24 Koolweerstand E24 reeks Résistance au carbone, série E24 Resistencia de carbón, serie E24	0,125 W	5%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	0,25 W ≦ 1 MΩ, > 1 MΩ,	5% 10%
Carbon resistor E24 series Kohleschichtwiderstand, Reihe E24 Koolweerstand E24 reeks Résistance au carbone, série E24 Resistencia de carbón, serie E24	0,5 W ≦ 5 MΩ, > 5 ≦ 10 MΩ, > 10 MΩ,	1% 2% 5%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	0,5 W ≦ 1,5 MΩ, > 1,5 MΩ,	5% 10%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	1 W ≦ 2,2 MΩ, > 2,2 MΩ,	5% 10%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	2 W	5%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	0,4 – 1,8 W	0,5%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	5,5 W ≦ 200 Ω, > 200 Ω,	10% 5%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	10 W	5%

Tubular ceramic capacitor Rohrkondensator Keramische kondensator, buistype Condensateur céramique tubulaire Condensador cerámico tubular	500 V
Tubular ceramic capacitor Rohrkondensator Keramische kondensator, buistype Condensateur céramique tubulaire Condensador cerámico tubular	700 V
Ceramic capacitor, "pin-up" Keramikkondensator "Pin-up" (Perltyp) Keramische kondensator "Pin-up" type Condensateur céramique, type perle Condensador cerámico, versión "colgable"	500 V
"Microplate" ceramic capacitor Miniatur-Scheibenkondensator "Microplate" keramische kondensator Condensateur céramique "microplate" Condensador cerámico "microplaca"	30 V
Mica capacitor Glimmerkondensator Micakondensator Condensateur au mica Condensador de mica	500 V
Polyester capacitor Polyesterkondensator Polyesterkondensator Condensateur au polyester Condensador polyester	400 V
Flat-foil polyester capacitor Miniatur-Polyesterkondensator (flach) Platte miniatuur polyesterkondensator Condensateur au polyester, type plat Condensador polyester, tipo de placas planas	250 V
Paper capacitor Papierkondensator Papierkondensator Condensateur au papier Condensador de papel	1000 V
Wire-wound trimmer Drahttrimmer Draadgewonden trimmer Trimmer à fil Trimmer bobinado	
Tubular ceramic trimmer Rohrtrimmer Buisvormige keramische trimmer Trimmer céramique tubulaire Trimmer cerámico tubular	

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS

CAPACITORS

Nr.	*Ordering number*	*Value*	*Voltage (V)*	*Description*
C1	5322 120 64078	82 pF	500	Mica
C2	5322 120 64103	680 pF	500	Mica
C3	5322 121 54005	6.8 nF	63	
C4	5322 121 50401	68 nF	63	
C5	5322 121 40219	680 nF	100	
C6	5322 124 10073	6.8 μF	6	Electrolytic
C7	5322 124 10016	68 μF	15	Electrolytic
C8...C9	5322 124 10156	330 μF	6	Electrolytic
C12	5322 120 64069	39 pF	500	Mica
C13	5322 120 64097	430 pF	500	Mica
C14	5322 121 50512	4.7 nF	63	
C15	5322 121 50375	47 nF	63	
C16	5322 121 40218	470 nF	100	
C17	5322 124 10157	4.7 μF	10	Electrolytic
C18	5322 124 10013	47 μF	6	Electrolytic
C22	5322 120 64069	39 pF	500	Mica
C23	5322 120 64097	430 pF	500	Mica
C24	5322 121 50512	4.7 nF	63	
C25	5322 121 50375	47 nF	63	
C26	5322 121 40218	470 nF	100	
C27	5322 124 10157	4.7 μF	10	Electrolytic
C28	5322 124 10013	47 μF	6	Electrolytic
C31...C32	5322 121 20067	5 nF	5000	
C41...C42	5322 124 70235	2x5000 μF		Electrolytic
C101	5322 124 20532	250 μF	25	Electrolytic
C102	5322 122 30021	100 pF		Ceramic
C103	5322 122 30027	1 nF		Ceramic
C104	5322 124 20488	80 μF	25	Electrolytic
C105...C106	5322 124 20532	250 μF	25	Electrolytic
C107	5322 122 30021	100 pF		Ceramic
C108	5322 124 20214	100 μF	6.4	Electrolytic
C109	5322 124 20353	10 μF	25	Electrolytic
C201	5322 122 30043	10 nF	40	Ceramic
C202...C204	5322 124 20353	10 μF	25	Electrolytic
C205	5322 122 30043	10 nF	40	Ceramic
C208	5322 122 30043	10 nF	40	Ceramic
C210	5322 122 30043	10 nF	40	Ceramic
C212...C212	5322 122 30043	10 nF	40	Ceramic
C225	5322 124 20353	10 μF	25	Electrolytic
C226...C227	5322 122 30043	10 nF	40	Ceramic
C301...C302	5322 124 20575	100 μF	25	Electrolytic
C303...C304	5322 121 40323	0.1 μF	100	
C305...C307	5322 122 34006	10 nF	50	
C308...C312	5322 121 40323	0.1 μF	100	
C313...C314	5322 124 20362	22 μF	25	Electrolytic

)TENTIOMETERS

	Ordering number	Value	Description
71	5322 102 30115	500 Ω + 1.5 kΩ	Logarithmic, tandem
72...RV3	5322 101 20256	22 kΩ	Logarithmic
74	5322 102 30114	5 kΩ + 5 kΩ	Linear, tandem
75	5322 101 24006	1 kΩ	Linear
76*	5322 102 30114	5 kΩ+ 5 kΩ	Linear, tandem
77*	5322 101 24006	1 kΩ	Linear
7101...RV102	5322 101 14003	500 Ω	Trimming potentiometer
7202	5322 100 10113	10 kΩ	Trimming potentiometer
7203	5322 101 14004	50 Ω	Trimming potentiometer
7204	5322 101 14005	2 kΩ	Trimming potentiometer
7205	5322 101 14003	500 Ω	Trimming potentiometer
7206	5322 100 10112	1 kΩ	Trimming potentiometer
7207	5322 101 14006	50 kΩ	Trimming potentiometer
7208	5322 101 14003	500 Ω	Trimming potentiometer
7209	5322 101 14007	200 Ω	Trimming potentiometer
7210	5322 101 14006	50 kΩ	Trimming potentiometer
7211	5322 101 14003	500 Ω	Trimming potentiometer
7212	5322 101 14007	200 Ω	Trimming potentiometer
7301	5322 101 14011	100 Ω	Trimming potentiometer
7302	5322 101 14009	220 Ω	Trimming potentiometer
7303	5322 100 10112	1 kΩ	Trimming potentiometer
7304...RV305	5322 101 14008	2.2 kΩ	Trimming potentiometer

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* Applies for PM 5776 only

RESISTORS

Nr.	*Ordering number*	*Value*	*Tolerance %*	*Description*
R305...R306	5322 116 50199	2.74 kΩ	1	Metal film
R307	5322 116 50751	150 Ω	1	Metal film
R313...R314	5322 116 50532	2.21 kΩ	1	Metal film
R315	5322 116 50751	150 Ω	1	Metal film
R319...R320	5322 116 50952	47.5 Ω	1	Metal film
R325	5322 116 50268	100 Ω	1	Metal film
R326...R327	5322 116 50527	33.2 Ω	1	Metal film
R330	5322 116 50268	100 Ω	1	Metal film
R333	5322 116 50452	10 Ω	1	Metal film
R334...R335	5322 116 50983	22.1 Ω	1	Metal film
R337	5322 116 50452	10 Ω	1	Metal film
R339	5322 116 50452	10 Ω	1	Metal film
R340...R341		1.2 kΩ		Metal film
R342	5322 116 50952	47.5 Ω	1	Metal film
R344...R345	5322 116 50527	33.2 Ω	1	Metal film
R347	5322 116 50452	10 Ω	1	Metal film
R356...R357	5322 116 50003	121 Ω	1	Metal film
R358...R359	5322 116 50268	100 Ω	1	Metal film
R360...R361	5322 116 50359	68.1 Ω	1	Metal film
R362	5322 116 50527	33.2 Ω	1	Metal film
R381...R382	5322 116 50757	51.1 Ω	1	Metal film
R383...R384	5322 116 50521	56.2 Ω	1	Metal film
R385...R386	5322 116 50918	75 Ω	1	Metal film
R400	5322 111 30326	180 Ω	5	Carbon
R401	5322 116 50003	121 Ω	1	Metal film

MI CONDUCTORS

	Type	Ordering number	Remarks
..Z2	2N3055	5322 130 40132	
	VH 248	5322 130 34042	Varo Inc.
)1	2N1613	5322 130 40127	
)6	2N1613	5322 130 40127	
)7	BZY88-C6V8	5322 130 30079	
)8...Z109	BCY70	5322 130 40324	
.0	BZY88-C6V8	5322 130 30079	
1	BC108	5322 130 40309	
2	2N2219	5322 130 40496	
)1...Z202	BAX13	5322 130 40182	
)3...Z204	BFX89	5322 130 40542	
)5	BZY88-C5V1	5322 130 30284	
)6	BFW30	5322 130 40379	
)7	BF180	5322 130 40492	Alt. BF183
)8	BFW30	5322 130 40379	
0	HP5082-2800	5322 130 30635	Hewlett Packard
1	2N709	5322 130 40495	
2...Z213	BAX13	5322 130 40182	
.4	BF180	5322 130 40492	Alt. BF183
5	2N3905	5322 130 40171	Motorola
6	BZY88-C5V1	5322 130 30284	
.7	BFX89	5322 130 40542	
8	2N3905	5322 130 40171	Motorola
.9	BZY88-C5V1	5322 130 30284	
20	BFX89	5322 130 40542	
21	BCY70	5322 130 40324	
22	2N709	5322 130 40495	
23...Z224	BFX89	5322 130 40542	
25	2N709	5322 130 40495	
26	BAX13	5322 130 40182	
27...Z228	BAY82	5322 130 30202	Alt. FD777, Fairchild 5322 130 34045
29	2N709	5322 130 40495	
30	2N709 (selected) *	5322 130 40742	Alt. selected BSX44** 5322 130 40183
31	BCY70	5322 130 40324	
32	BAY82	5322 130 30202	Alt. FD777, Fairchild 5322 130 34045
33	BZY88-C7V5	5322 130 30287	
34	BFW16	5322 130 40381	
35...Z236	BFX89	5322 130 40542	
37	BZY88-C3V3	5322 130 30392	
38	2N709	5322 130 40495	
39	BAX13	5322 130 40182	
40...Z241	BFX89	5322 130 40542	
42	BCY70	5322 130 40324	
-3...Z245	BFX89	5322 130 40542	

Nr.	*Type*	*Ordering number*	*Remarks*
Z246	2N709	5322 130 40495	
Z247	BAX13	5322 130 40182	
Z248...Z249	BAY82	5322 130 30202	Alt. FD777, Fairchild 5322 130 34045
Z250	2N709	5322 130 40495	
Z251	2N709 (selected) *	5322 130 40742	Alt. selected BSX44 ** 5322 130 40183
Z252	BCY70	5322 130 40324	
Z253	BAY82	5322 130 30202	Alt. FD777, Fairchild 5322 130 34045
Z254	BZY88-C9V1	5322 130 30294	
Z255	BFW16	5322 130 40381	
Z256...Z257	BFX89	5322 130 40542	
Z258	BZY88-C5V1	5322 130 30284	
Z259	BF180	5322 130 40492	Alt. BF183
Z301	BZY88-C7V5	5322 130 30287	
Z302...Z303	BFW92	5322 130 40745	
Z304	2N2369	5322 130 40407	
Z305	BZY88-C7V5	5322 130 30287	
Z306...Z307	BFW92	5322 130 40745	
Z308	2N2369	5322 130 40407	
Z309...Z311	BFW30	5322 130 40379	
Z312	BZY88-C4V3	5322 130 30509	
Z313...Z314	BFW30	5322 130 40379	
Z315	2N2219	5322 130 40496	
Z316...Z317	BZY88-C4V3	5322 130 30509	
Z318...Z319	BFW16	5322 130 40381	
Z320...Z321	BZY88-C4V3	5322 130 30509	
Z322...Z323	BFW16	5322 130 40381	
Z324...Z325	BZY88-C4V3	5322 130 30509	
Z326...Z327	2N2905	5322 130 40021	
Z328	BAX13	5322 130 40182	
Z329...Z330	2N5583	5322 130 44033	
Z331	BZY88-C3V3	5322 130 39392	
Z332	BFX49***	5322 130 44032	Alt. 219 BLY B***
Z333	HPA 1004	5322 130 34043	Hewlett Packard
Z334...Z336	2N2219	5322 130 40496	
Z237	BAX13	5322 130 40182	
Z339...Z340	2N2905	5322 130 40021	
Z341	BAX13	5322 130 40182	
Z342...Z343	BC107B	5322 130 40332	
Z344	2N2905	5322 130 40021	
Z345	BC178	5322 130 40355	Alt. BC177
Z346	2N2219	5322 130 40496	
Z347	BC107B	5322 130 40332	

* Selected for $h_{FE} > 60$ at $I_c = 25$ mA and $V_{CE} = 3$ V

** Selected for $h_{FE} > 60$ at $I_c = 25$ mA and $V_{CE} = 3$ V, $V_{CE} > 8$ V at I_c 10 mA.

*** Crop transistor leads as shown in Fig. XI-5

ISCELLANEOUS

g.	Item	Qty. PM 5775	Qty. PM 5776	Ordering number	Description
-4	DL201...202	2	2	5322 320 10003	Delay line/meter (required: 90 cm for each delay line)
	F1...F2	2	2	5322 253 30027	Fuse 5x20 mm, 3.15 A, delayed action
	L3	1	1	5322 526 10025	FXC bead 4B
	L4...L7	4	4	5322 526 10011	FXC bead 3B
	L8	1	1	5322 526 10025	FXC bead 4B
	L10	1	1	5322 526 10025	FXC bead 4B
	L11...L12	2	2	5322 526 10011	FXC bead 3B
	L201	1	1	5322 526 10011	FXC bead 3B
	L202	1	1	5322 526 10025	FXC bead 4B
	L203...L207	5	5	5322 526 10011	FXC bead 3B
	L209	1	1	5322 526 10025	FXC bead 4B
	L301...L302	2	4	5322 526 10025	FXC bead 4B
	L303	1	2	5322 158 10282	Coil, 0.33 μH
	L304	1	2	–	See Fig. XI-6
	L305	1	2	5322 158 10272	Coil, 2.2 μH
	L306...L312	7	14	5322 526 10025	FXC bead 4B
	L313	1	2	5322 526 10011	FXC bead 3B
	L314	1	2	5322 158 10272	Coil, 2.2 μH
	L315	1	2	5322 158 10307	Coil, 330 μH
	L316	1	2	5322 158 10311	Coil, 1 μH
	L317	1	2	–	See Fig. XI-6
	L320...L321	2	4	5322 281 64095	Coil for RE301 and RE302
	L323	1	2	5322 158 10243	Coil, 100 μH
	RE301...RE302	2	4	5322 280 24011	Reed relay assy
	T1	1	1	5322 146 24008	Mains transformer
	THF1	1	1	5322 252 20004	Thermal fuse
-4	–	1	1	5322 216 64011	Printed wiring board incl. components PM 5775-1 (power supply)
-4	–	1	1	5322 216 60212	Printed wiring board incl. components PM 5775-2 (timing circuit)
-4	–	1	2	5322 216 64012	Printed wiring board incl. components PM 5775-3 (output circuit)
-4	–	1	2	5322 466 14026	Printed wiring board PM 5775-4 for switch S8 (S10)

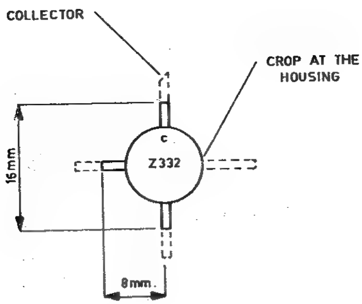


Fig. XI-5. Cropping transistor leads

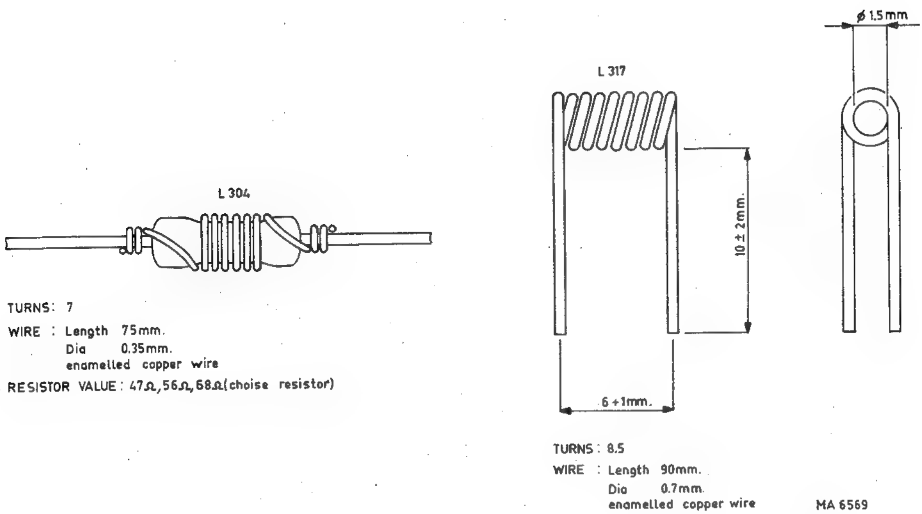


Fig. XI-6. Winding data for L304 and L317

II. INFORMATION CONCERNING COUPLING OF TWO PULSE GENERATORS PM 5775 AND ACCESSORIES REQUIRED

. GENERAL

For coupling two pulse generators PM 5775 to form one complete instrument (width 6 modules) coupling accessories are available. The coupling accessories required are a coupling kit and a cover kit. With the aid of the parts provided in the coupling kit the two pulse generators can be linked to each other.
The cover kit consists of parts concerning the cabinet with which the combination can be equipped to form one complete instrument.
When the combination is mounted in a 19" rack (Fig. XII-4) a rack-mounting kit is necessary.
The ordering numbers of the kits are:

Coupling kit	PM 9500
6-Module cover kit	PM 9506
Rack-mounting kit	PM 9510

The coupling kit PM 9500 includes (Fig. XII-1).

a. 4 coupling screws with nuts
b. 2 fixing screws for handle
c. 1 inter unit screen
d. 1 mains interconnection link
e. 2 signal interconnection links

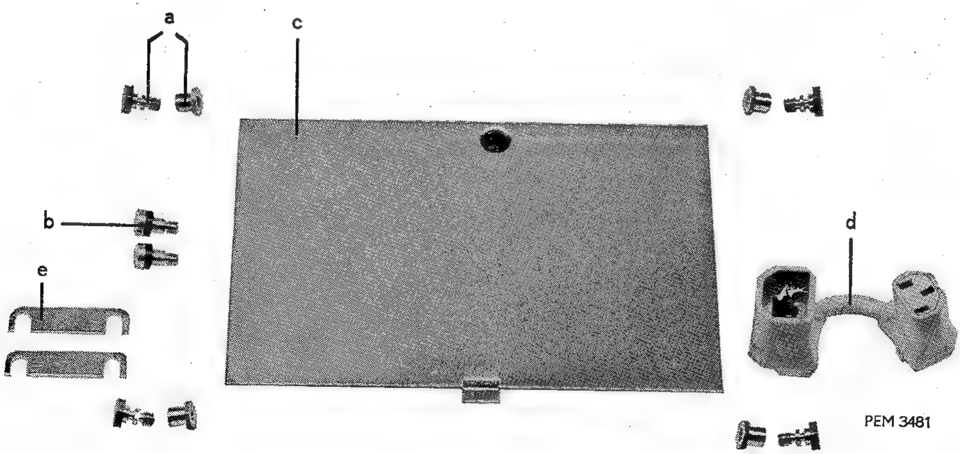


Fig. XII-1. Coupling kit

The 6-module cover kit PM 9506 includes (Fig. XII-2).

a. 1 6-module top cover
b. 1 6-module tilting assembly
c. 1 6-module handle bar

The rack-mounting kit PM 9510 includes:

- 2 brackets
- 2 handles
- 4 fixing screws
- 2 inter-unit screens

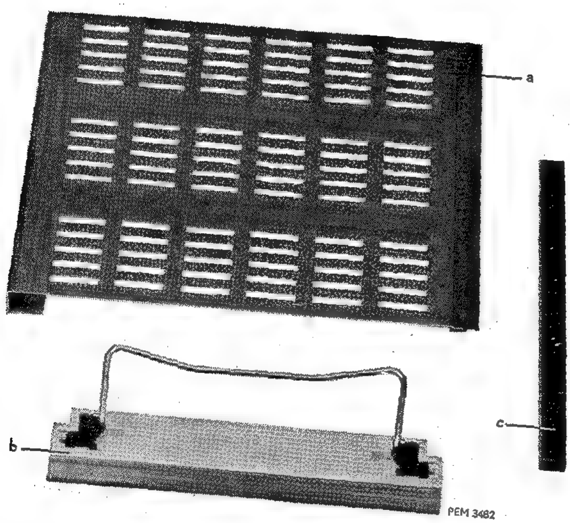


Fig. XII-2. Cover kit

. COUPLING INSTRUCTIONS (Fig. XII-5)

1. Detach the carrying handles by removing the screws on both sides of each unit.
2. Remove the handle bar and replace it by the bar, provided in the cover kit.
3. The side covers should be removed from the sides which are to be coupled and the inter-unit screen from the coupling kit should be fitted to one of the units at the place of the side cover removed.
4. Remove the top covers by loosening the screw(s) at the rear of each instrument.
5. Detach the bottom covers by removing the appropriate screw(s) at the rear of the instruments.
   Note: Ensure that the bottom covers are fitted to the instruments from which they have been taken (see point 10).
6. Remove the tilting assembly at the bottom of each instrument by pushing the two nylon slides "A" in the direction indicated in Fig. XII-3.
7. Remove the two feet at the coupling sides of each instrument.
   First loosen the grub screws which hold the surround.
8. Couple the instruments to each other by means of the nuts and bolts provided in the coupling kit.
9. Fit the tilting assembly supplied in the cover kit, to the bottom of instrument by means of the two nylon slides.
10. Refit the appropriate bottom cover of each instrument (see point 5).
11. Fit the new top cover on the instrument by pushing it towards the front of the instrument.
12. Screw the extended carrying handle to the instrument.

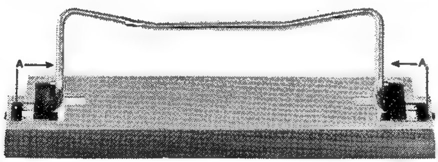


Fig. XII-3. Tilting assembly

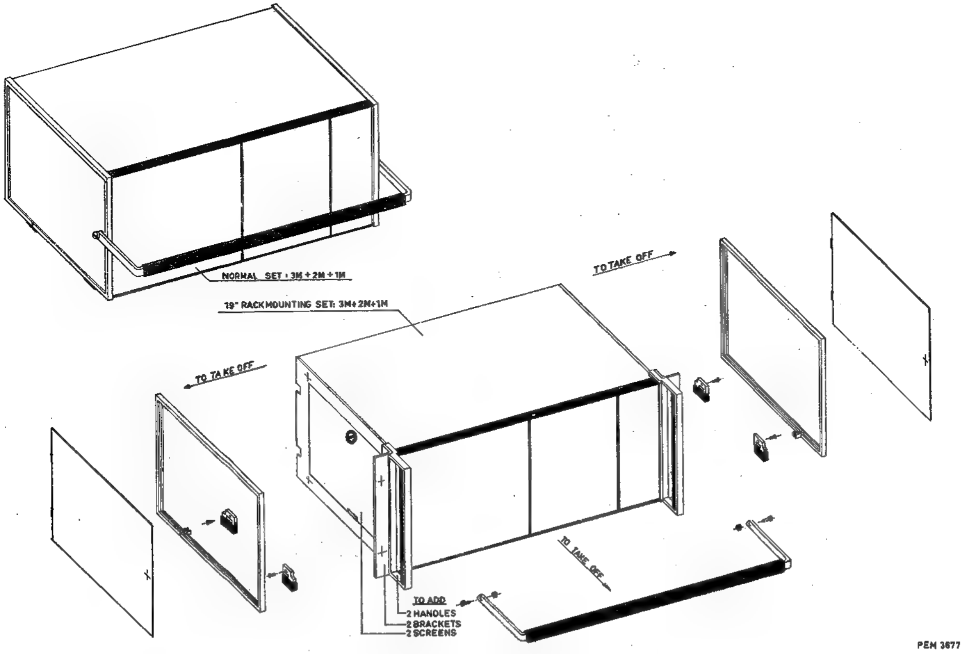


Fig. XII-4. Rack mounting, exploded view

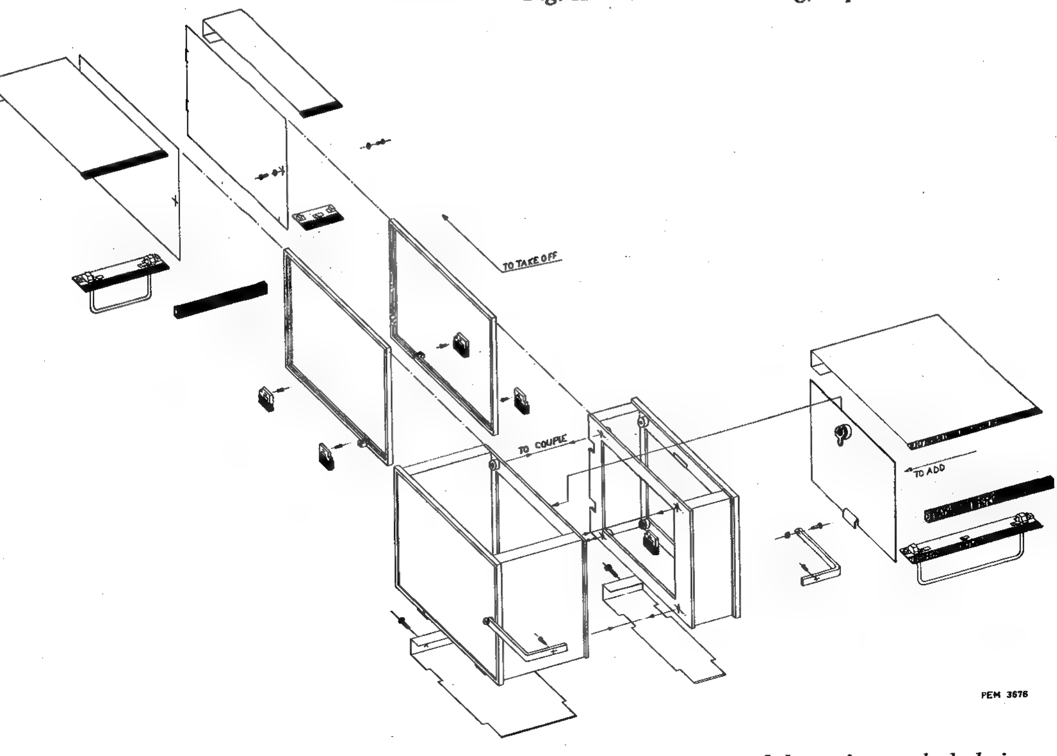


Fig. XII-5. Coupling two modular units, exploded view

III. FAULT FINDING PROCEDURE

With the aid of the fault finding procedure on the block diagram (Fig. XIII-1) one can easily determine that part of the circuit which is faulty. The procedure starts with the measurement of the output pulse on sockets PULSE OUT, P3 (P6) and is then further self-explanatory.
The encircled figures both in the block diagram and the circuit diagrams refer to the adjacent figures of the pulse diagram photographs.

Measuring instruments required:

Voltage measurements	: Voltmeter 40 kΩ/V	PHILIPS PM 2411
Oscillograms	: Sampling oscilloscope	PHILIPS PM 3400
	Cathode follower probe	PHILIPS PM 9345
	Attenuator heads	PHILIPS PM 9341

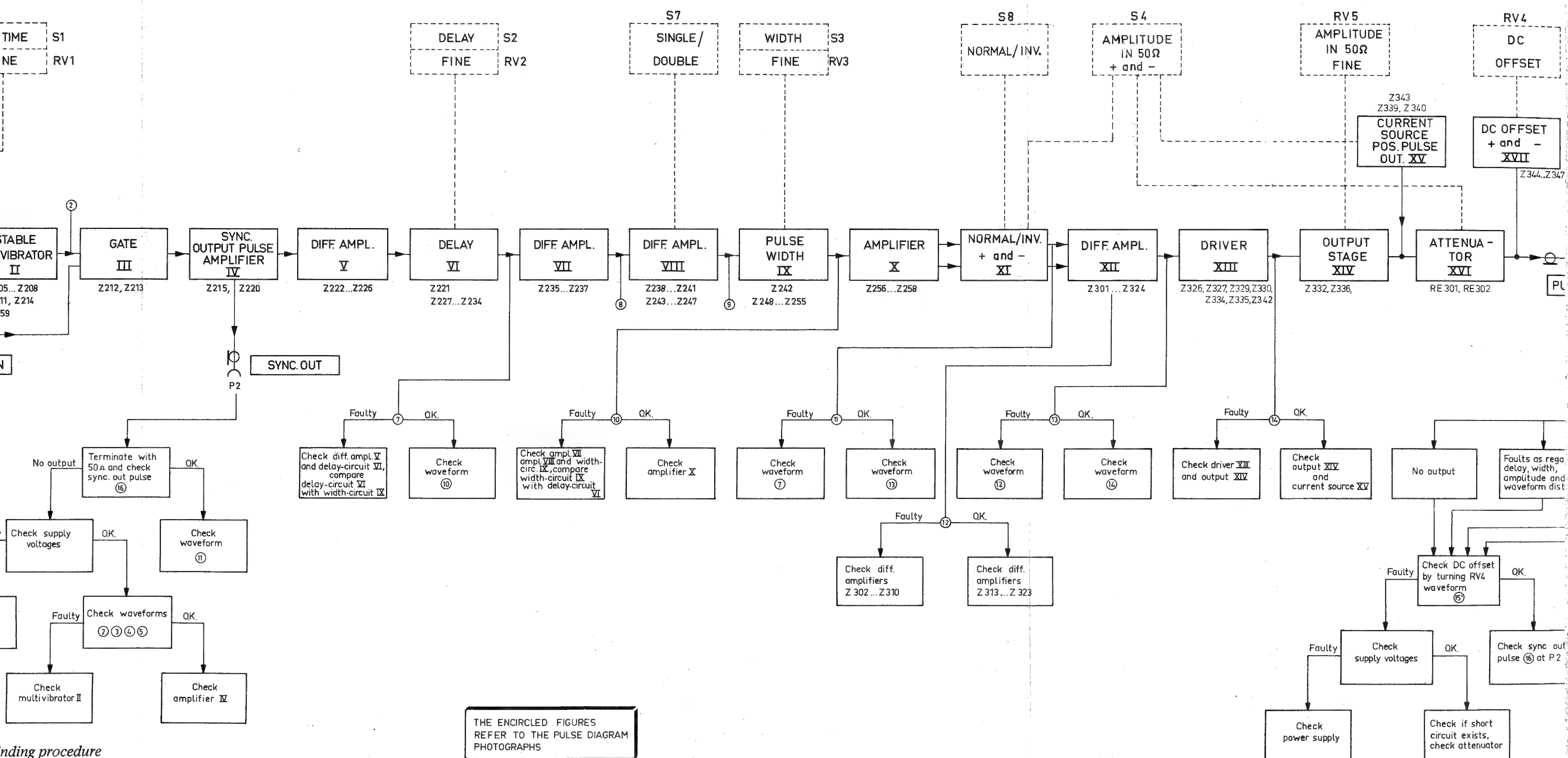
The oscilloscope should be externally triggered with the sync. output pulse taken from the pulse generator (connect the signal via a 20 dB attenuator, e.g. Texscan FP50, BNC Outline A).

Test conditions of PM 5775 (PM 5776)

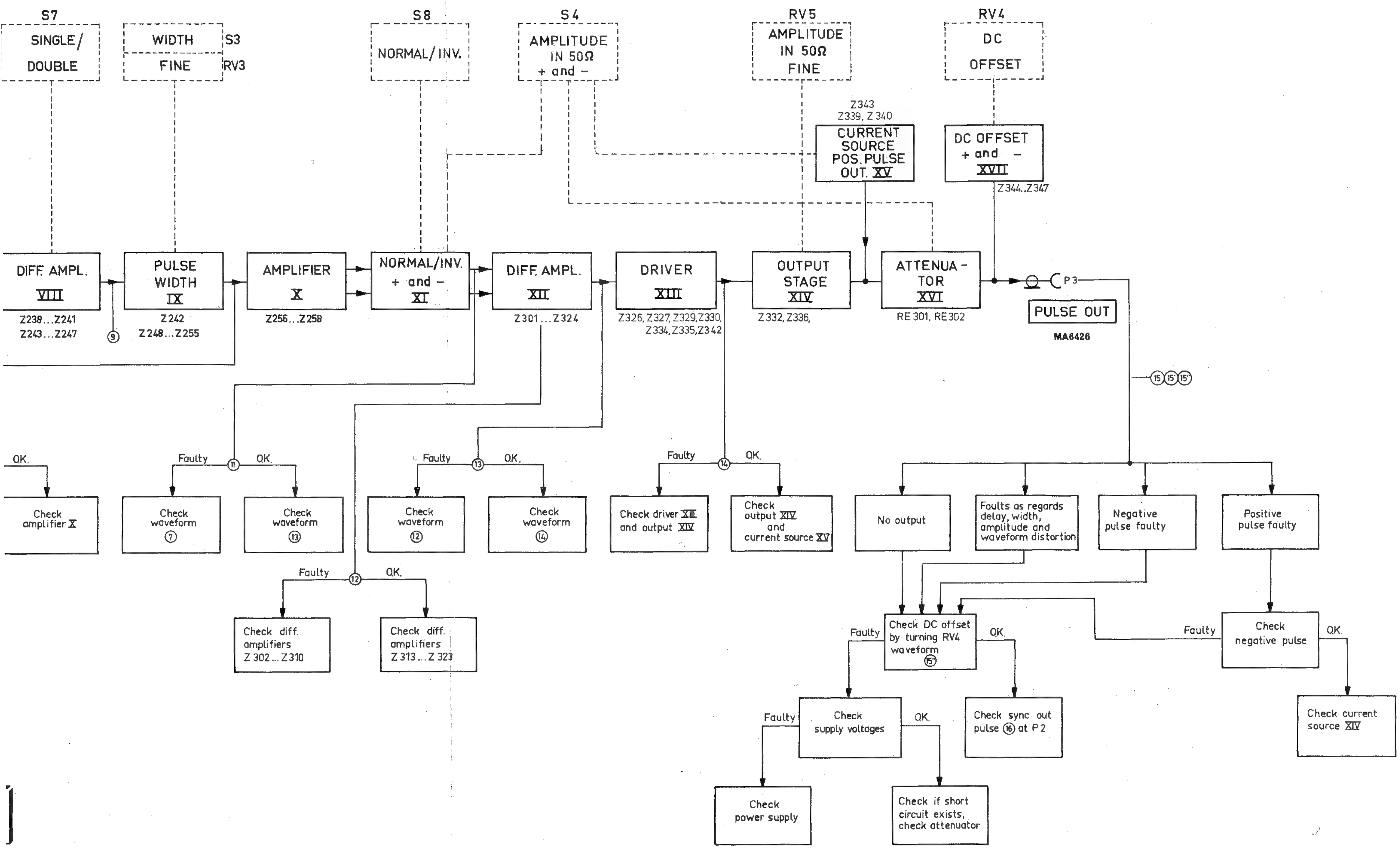
REPETITION TIME	S1	1 μs
REPETITION TIME FINE	RV1	black dot
DELAY	S2	5 ns *
DELAY FINE	RV2	black dot
WIDTH	S3	15 ns
WIDTH FINE	RV3	black dot
DC OFFSET IN 50 Ω	RV4 (RV6)	0 V
AMPLITUDE IN 50 Ω	S4 (S9)	+1 V
Vernier	RV5 (RV7)	MAX.
CONT.GATED	S6	CONT.
SINGLE DOUBLE	S7	SINGLE *
NORM. INV.	S8 (S10)	NORM.

Voltages and waveforms are typical and may vary between instruments.
All voltages given in the diagrams are in volts.

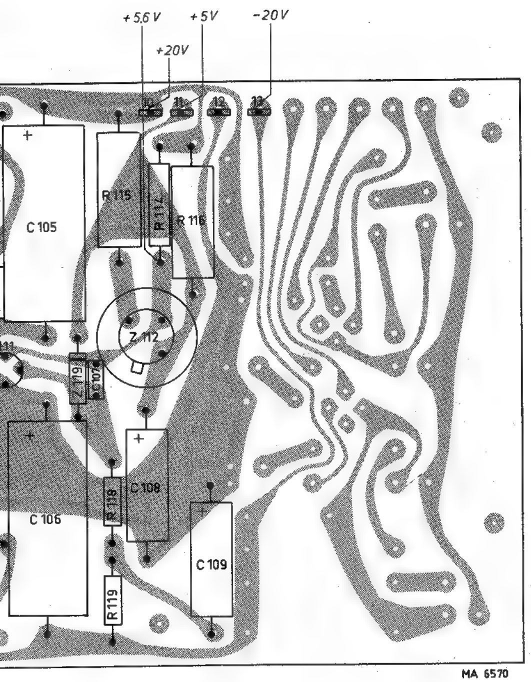
* Oscillograms 8' and 10' are obtained at a DELAY setting of 50 ns and with switch SINGLE DOUBLE, S7, in position DOUBLE.



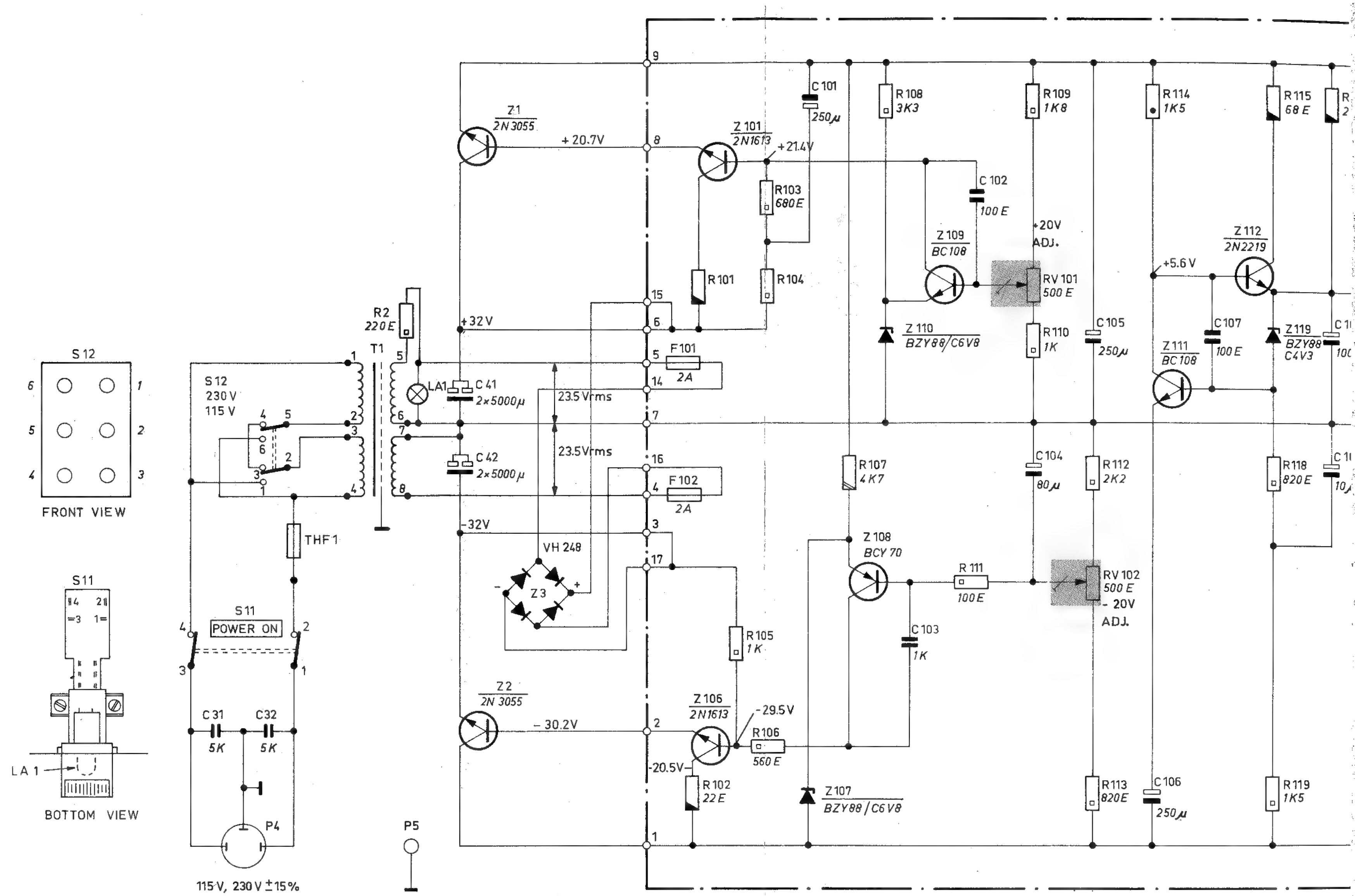
nding procedure



S7
SINGLE/
DOUBLE
WIDTH
FINE
S3
RV3
S8
NORMAL/INV.
S4
AMPLITUDE
IN 50Ω
+ and −
RV5
AMPLITUDE
IN 50Ω
FINE
RV4
DC
OFFSET
Z343
Z339, Z340
CURRENT
SOURCE
POS. PULSE
OUT. XV
DC OFFSET
+ and −
XVII
Z344..Z347
DIFF. AMPL.
VIII
Z238...Z241
Z243...Z247
9
PULSE
WIDTH
IX
Z242
Z248...Z255
AMPLIFIER
X
Z256...Z258
NORMAL/INV.
+ and −
XI
DIFF. AMPL.
XII
Z301...Z324
DRIVER
XIII
Z326, Z327, Z329, Z330,
Z334, Z335, Z342
OUTPUT
STAGE
XIV
Z332, Z336,
ATTENUA-
TOR
XVI
RE301, RE302
P3
PULSE OUT
MA6426
15 15' 15"
O.K.
Check
amplifier X
Faulty
11
O.K.
Check
waveform
7
Check
waveform
13
Faulty
13
O.K.
Check
waveform
12
Check
waveform
14
Faulty
14
O.K.
Check driver XIII
and output XIV
Check
output XIV
and
current source XV
No output
Faults as regards
delay, width,
amplitude and
waveform distortion
Negative
pulse faulty
Positive
pulse faulty
Faulty
12
O.K.
Check diff.
amplifiers
Z302...Z310
Check diff.
amplifiers
Z313...Z323
Faulty
Check DC offset
by turning RV4
waveform
15'
O.K.
Faulty
Check
negative pulse
O.K.
Faulty
Check
supply voltages
O.K.
Check sync out
pulse 16 at P2
Check current
source XIV
Check
power supply
Check if short
circuit exists,
check attenuator



...ply, component side



Errata
Value of fuses F101 and F102: 3.15 A, delayed action

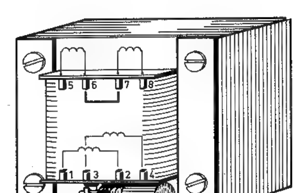
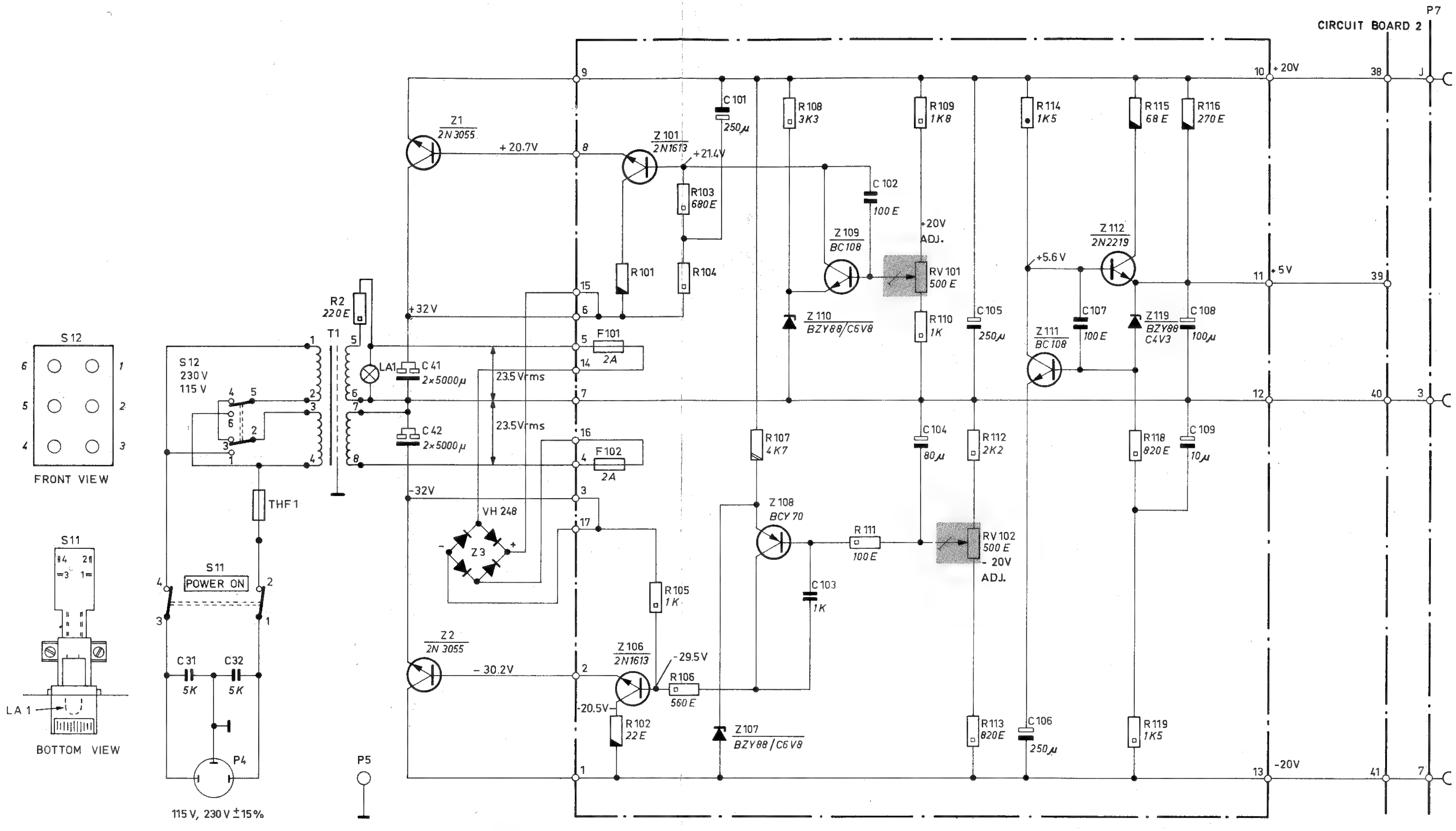
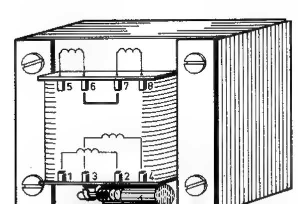


Fig. XI

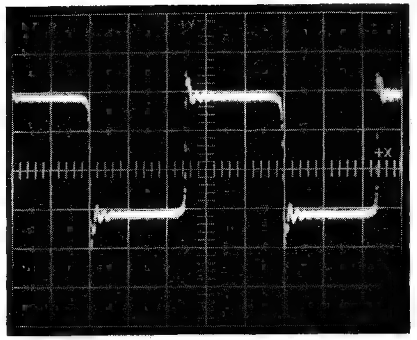




Errata
Value of fuses F101 and F102: 3.15 A, delayed action

Fig. XIV-2. Circuit diagram power supply

1



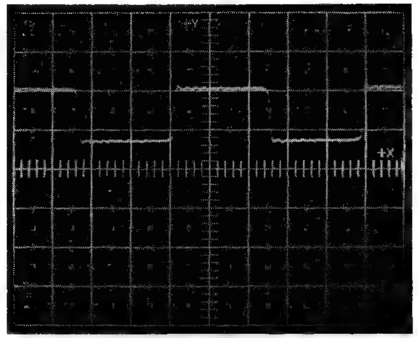
0

250 mV/cm

0.2 μs/cm

Collector Z206

2



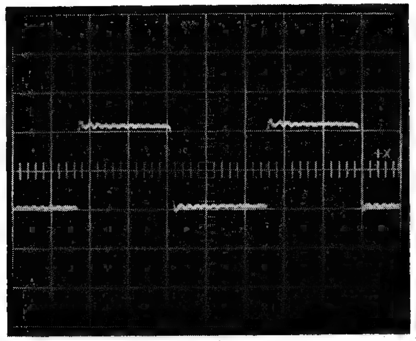
2.5 V/cm

0

0.2 μs/cm

Cathode Z213

3



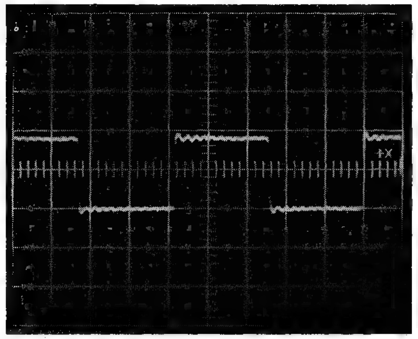
1 V/cm

0

0.2 μs/cm

Cathode Z216

4



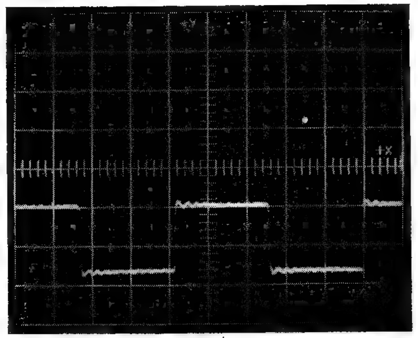
1 V/cm

0

0.2 μs/cm

Cathode Z219

5



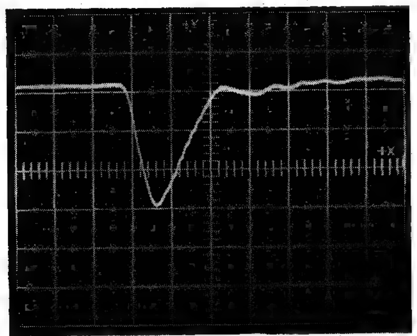
0

1 V/cm

0.2 μs/cm

Base Z220

6

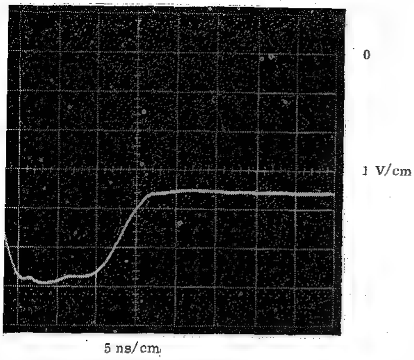


1 V/cm

0

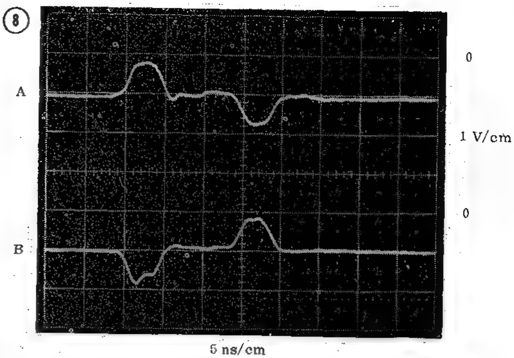
5 ns/cm

Anode Z227

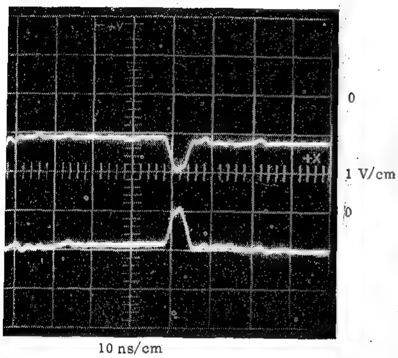


234

8

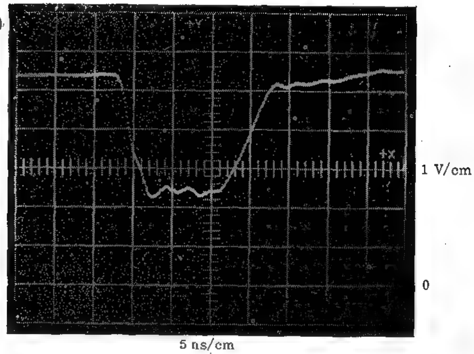


A. Base Z238
B. Base Z246

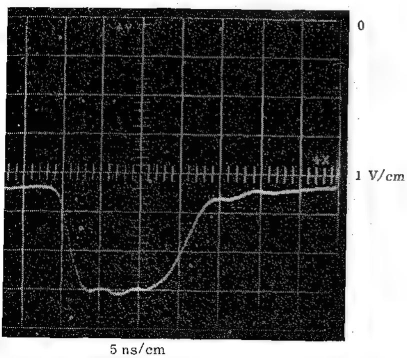


se mode
adjusted to 50 ns
238
246

9

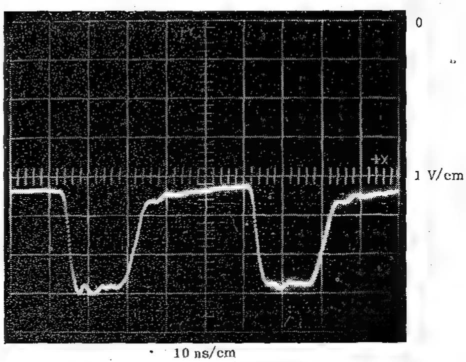


Anode Z248



255

10



Double pulse mode
Delay time adjusted to 50 ns
Emitter Z255

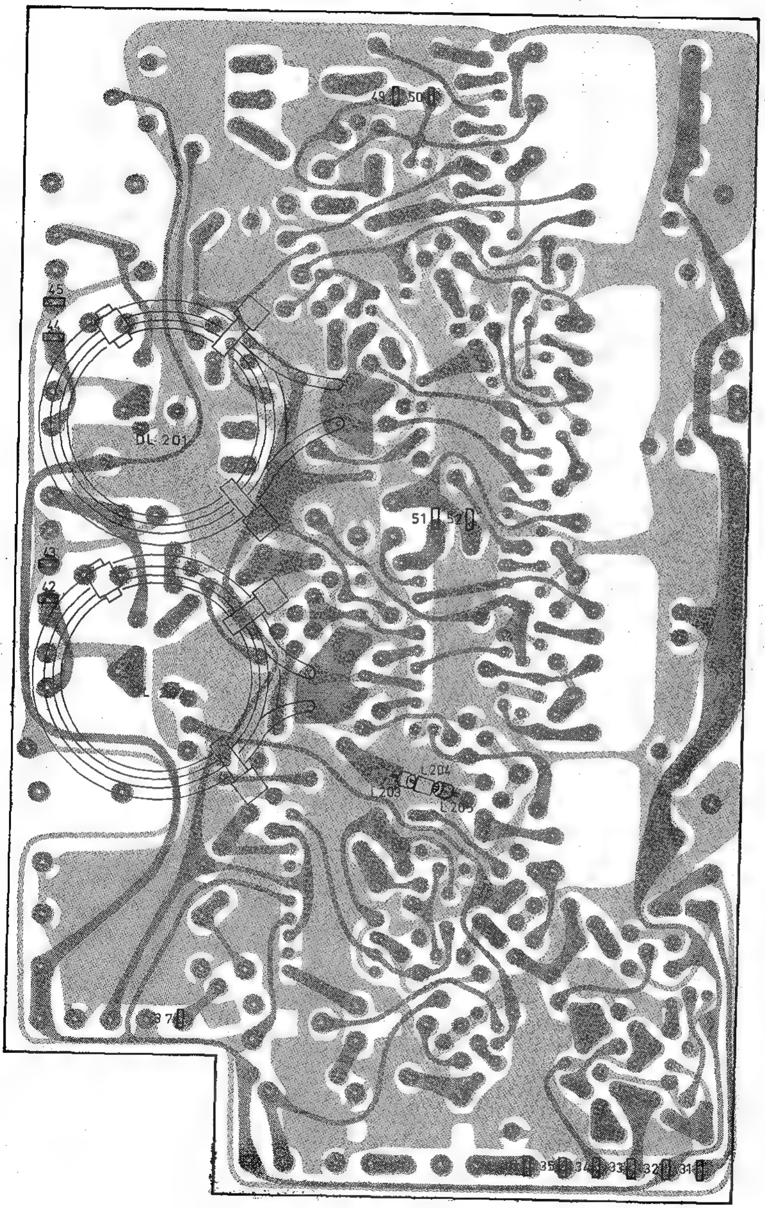
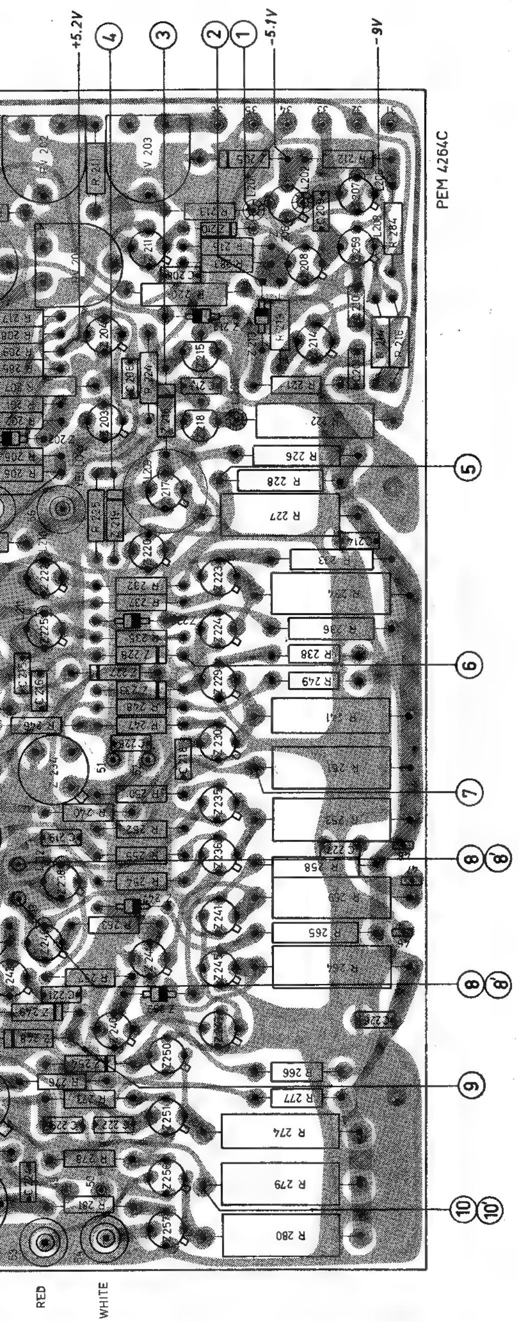
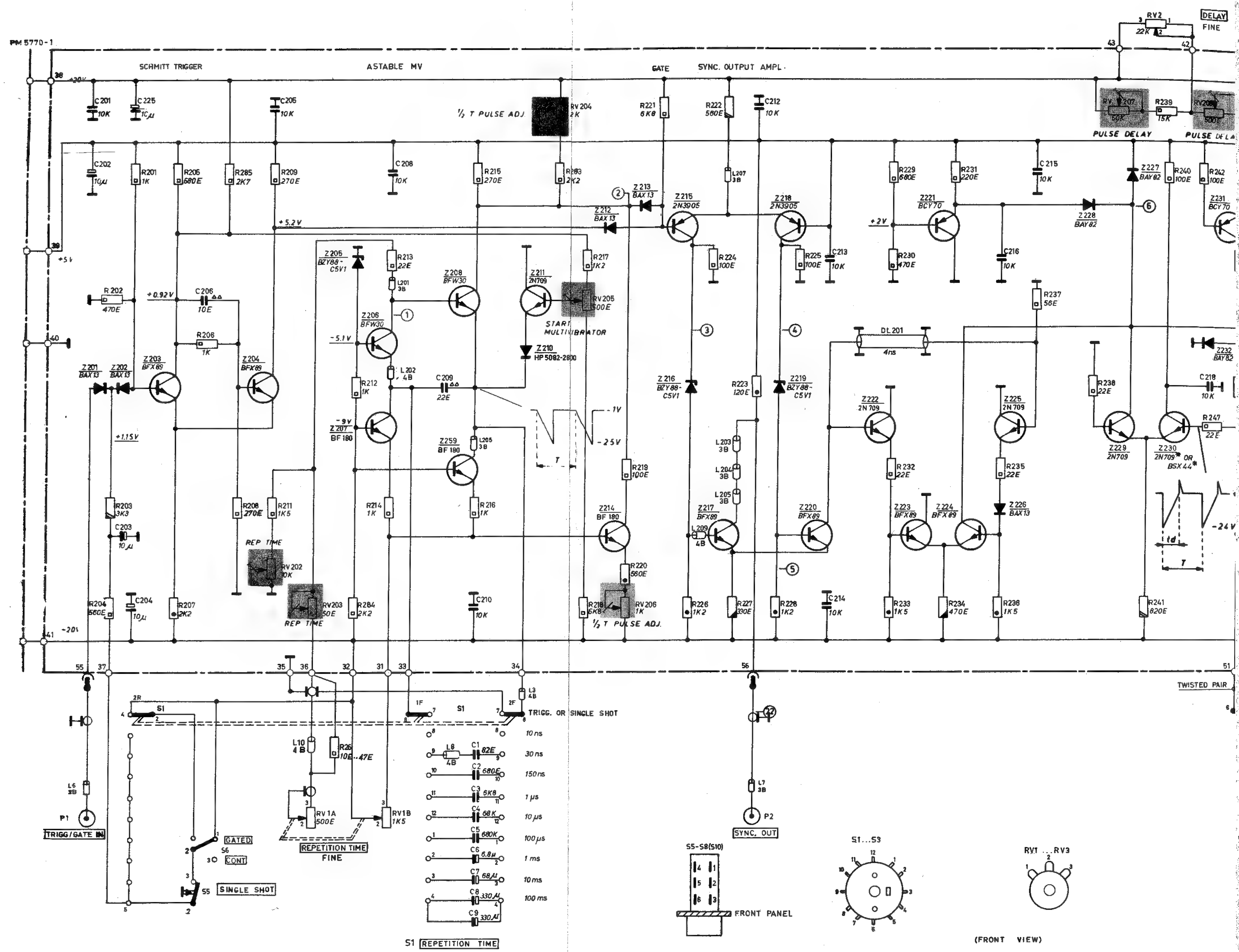


Figure XIV-3. Circuit board timing circuit, soldering side





uit, component side

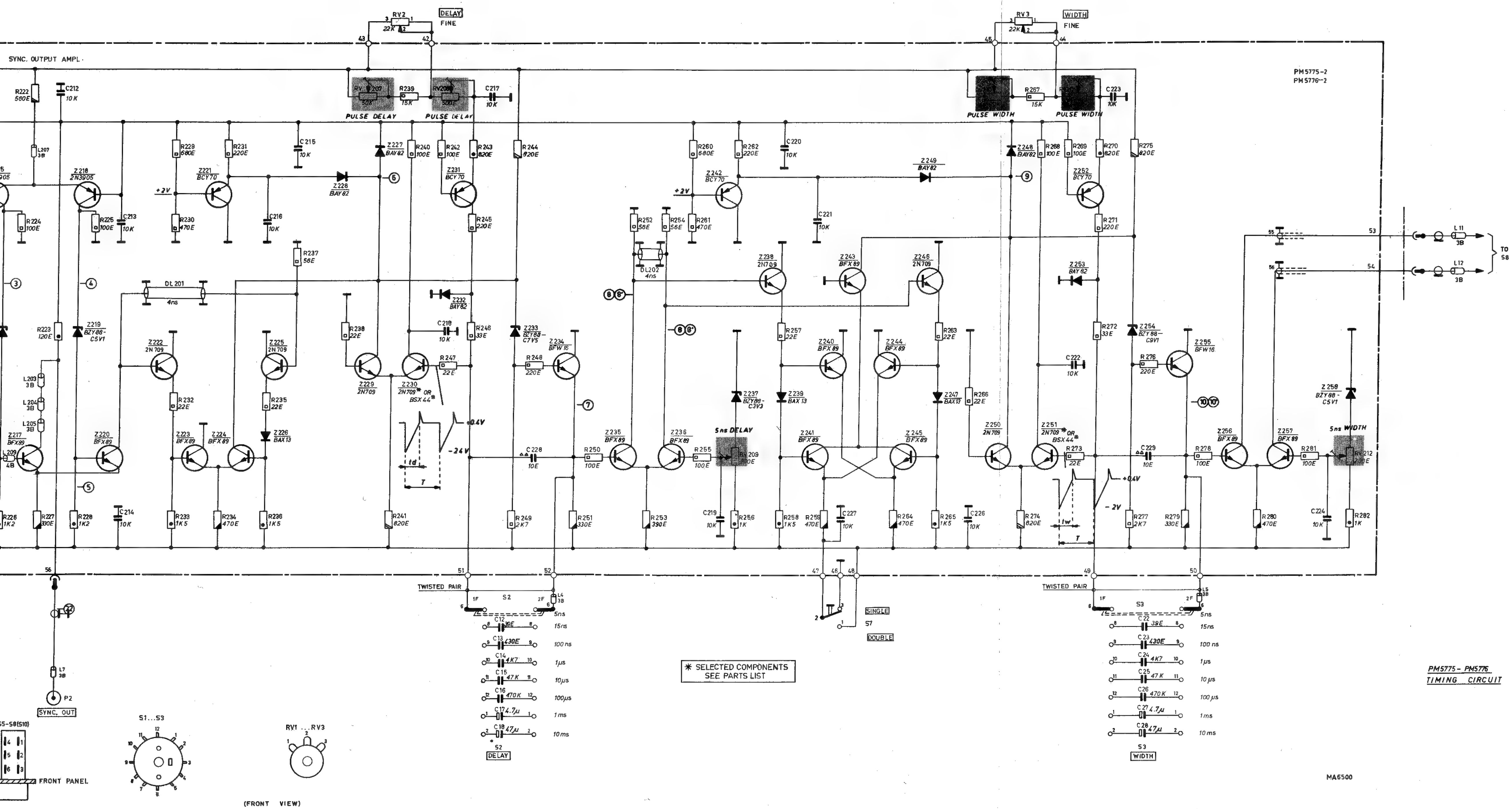
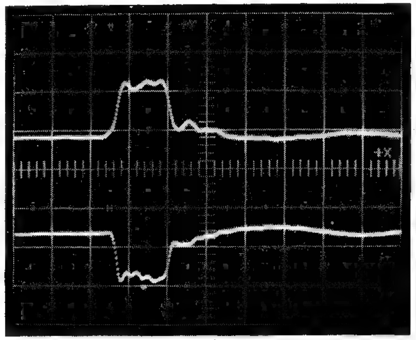


Fig. XIV-5. Circuit diagram timing circuit

11

0

A



1 V/cm

0

B

10 ns/cm

A. Cathode Z301
B. Cathode Z305

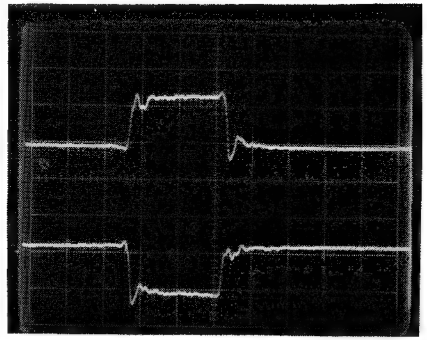
12

0

A

0

B



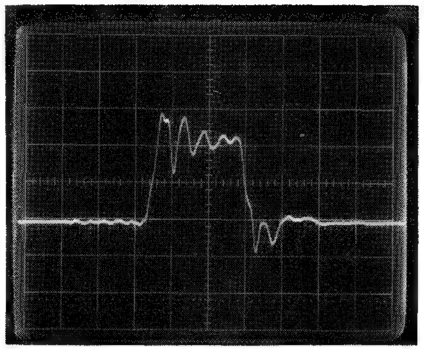
1 V/cm

A. Collector Z310
B. Collector Z309

5 ns/cm

13

0 V



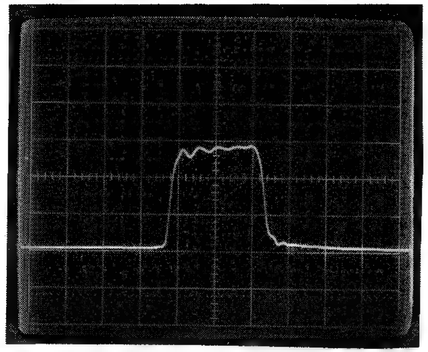
1 V/cm

5 ns/cm

Collector Z323

14

0 V

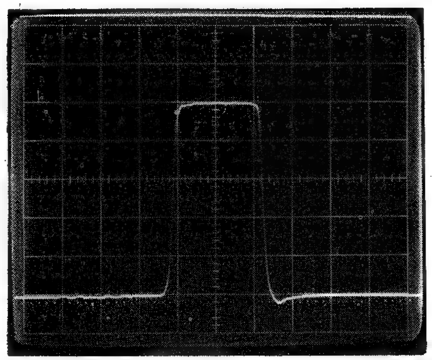


5 V/cm

5 ns/cm

Collector Z330

15



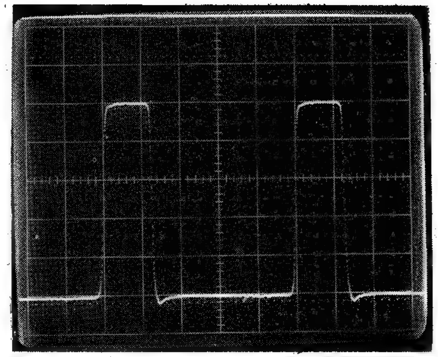
200 mV/cm

0 V

5 ns/cm

Output pulse at connector PULSE OUT (P3)

15'



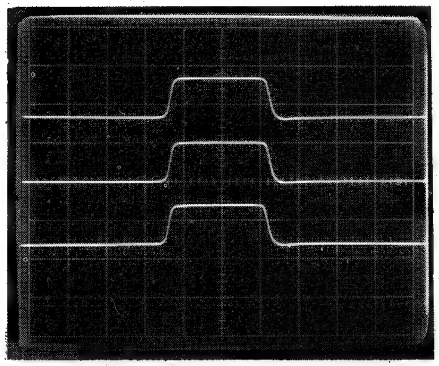
200 mV/cm

0 V

10 ns/cm

Double pulse at connector PULSE OUT (P3)
Delay time adjusted to 50 ns

15''



.5 V

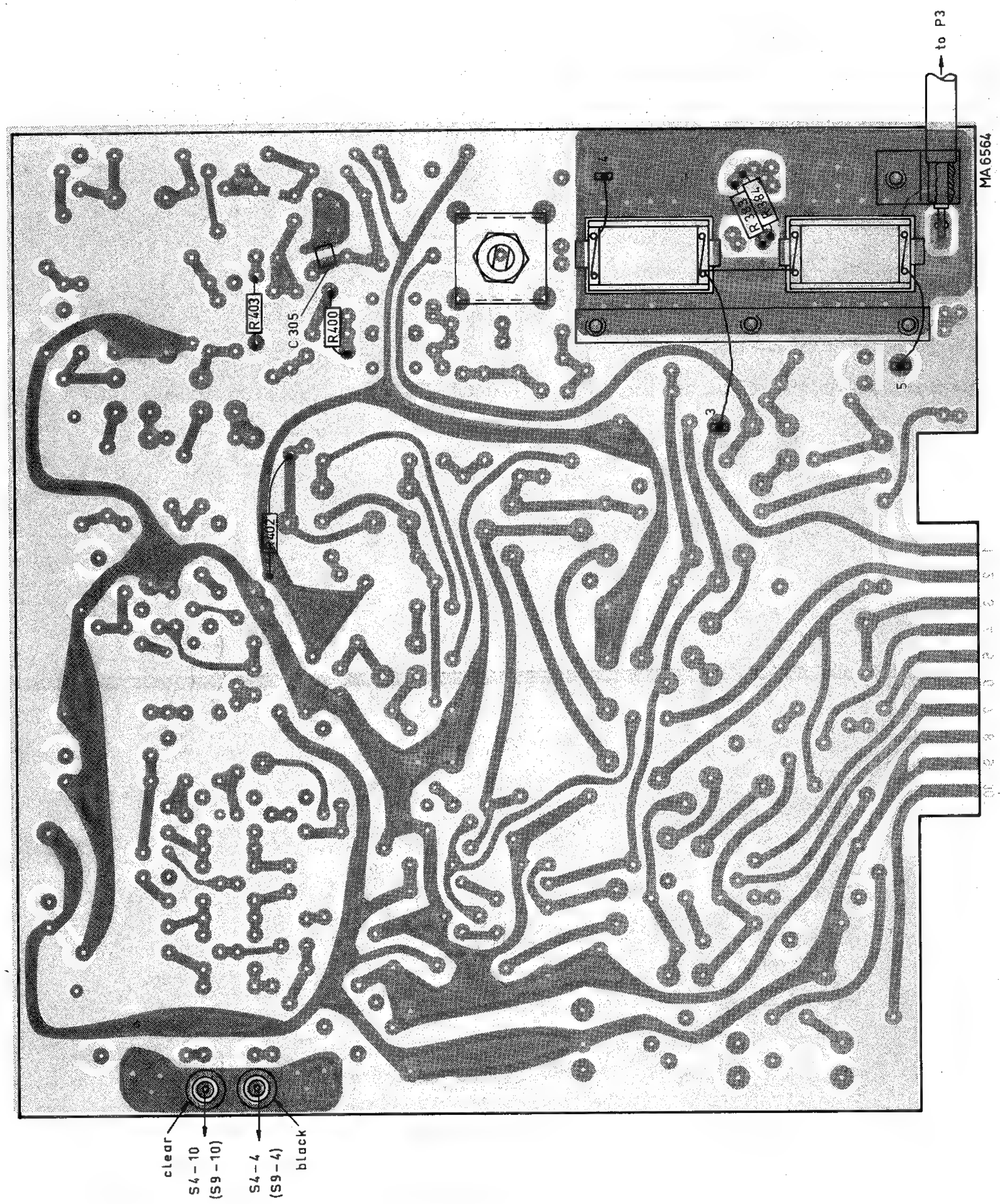
0 V

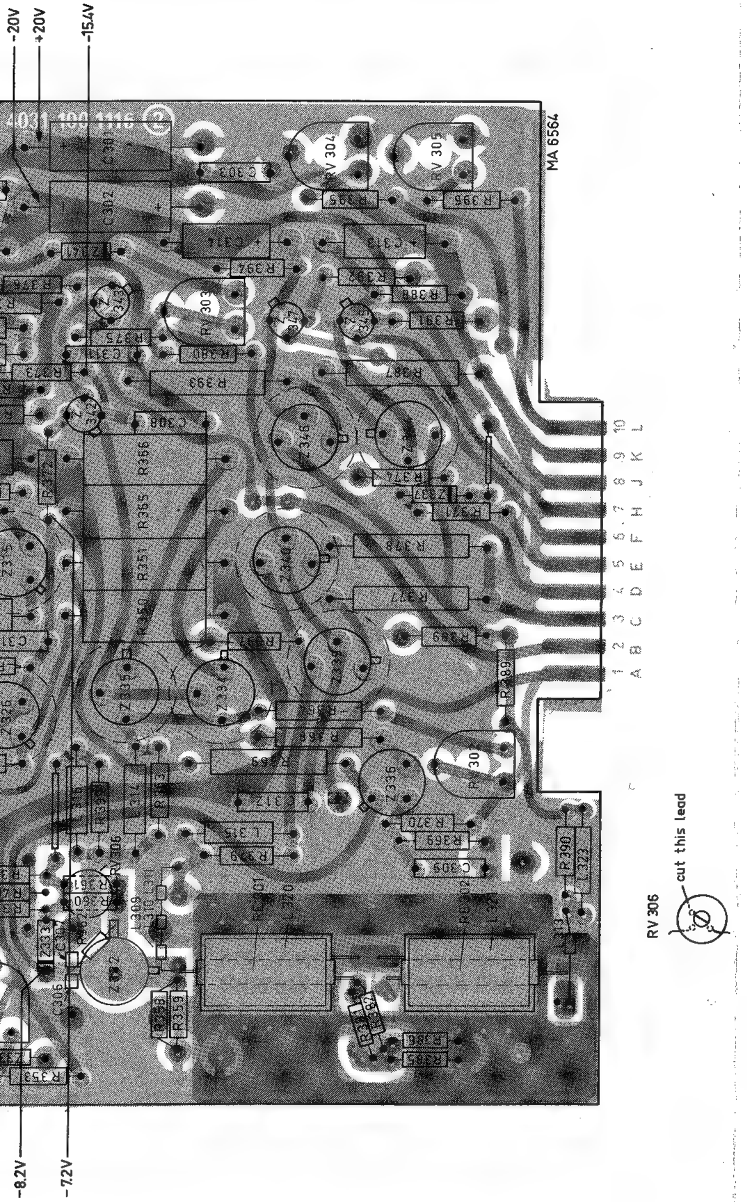
.5 V

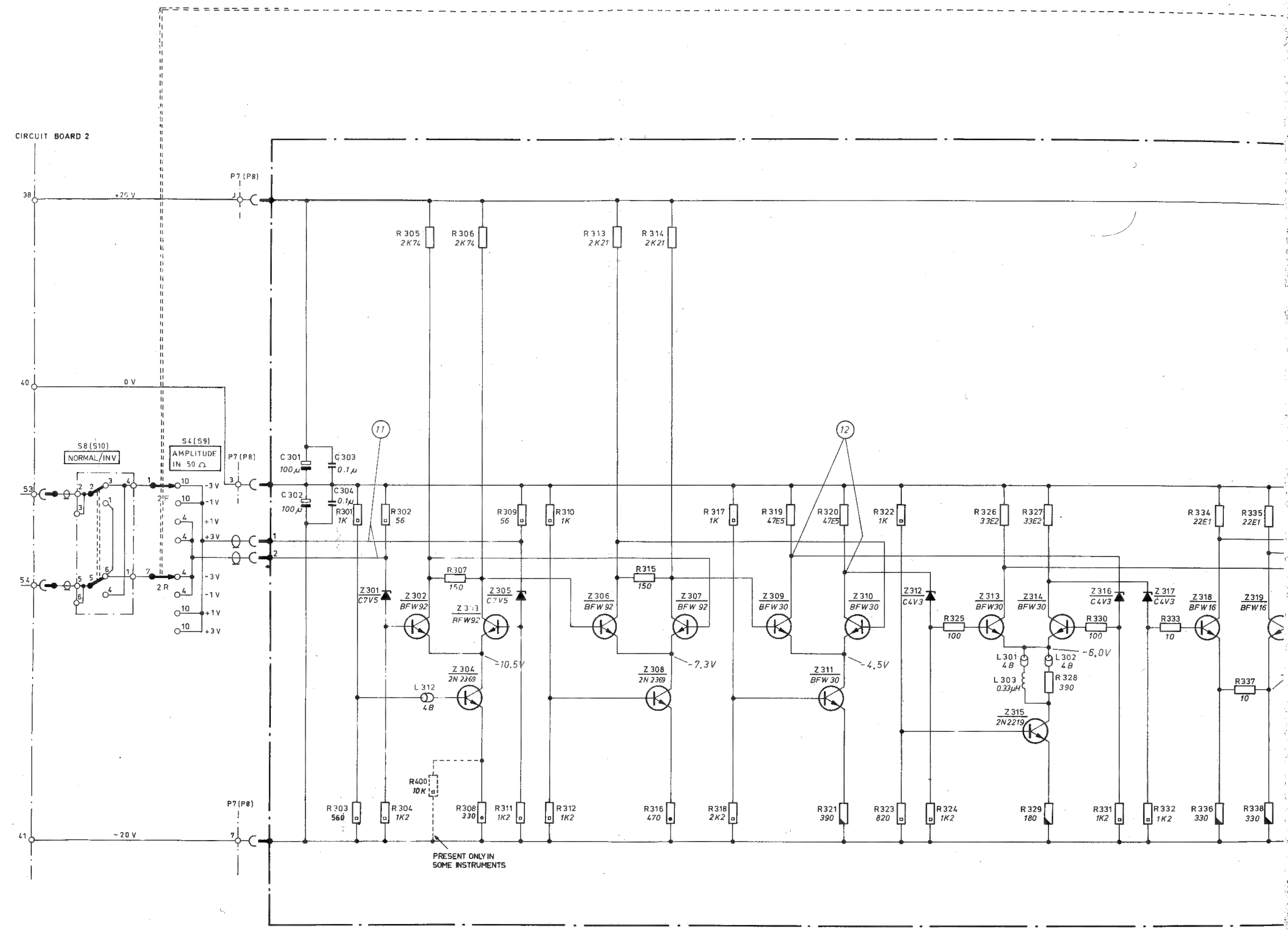
1 V/cm

5 ns/cm

Output pulse at connector PULSE OUT (P3)
DC offset voltage is varied ± 1.5 V

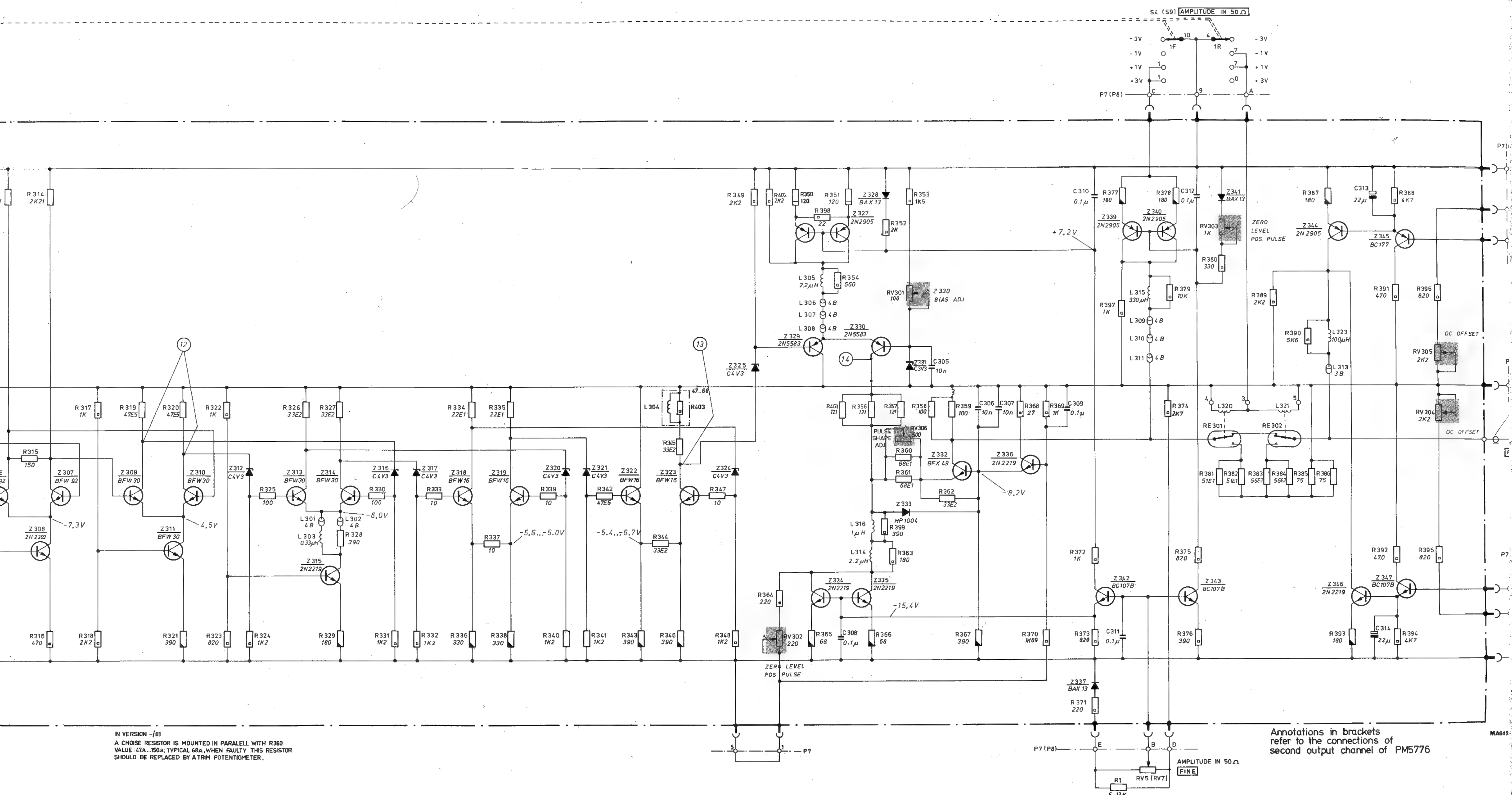

to P3
MA 6564
R 403
C 305
R 400
R 402
clear
S4-10
(S9-10)
S4-4
(S9-4)
black





IN VERSION -/01
A CHOISE RESISTOR IS MOUNTED IN PARALELL WITH R360
VALUE: 47Ω...150Ω; TYPICAL 68Ω, WHEN FAULTY THIS RESISTOR
SHOULD BE REPLACED BY A TRIM POTENTIOMETER.

cuit, component side



IN VERSION -/01
A CHOISE RESISTOR IS MOUNTED IN PARALELL WITH R360
VALUE: 47Ω...150Ω; TYPICAL 68Ω, WHEN FAULTY THIS RESISTOR
SHOULD BE REPLACED BY A TRIM POTENTIOMETER.

Annotations in brackets
refer to the connections of
second output channel of PM5776

Fig. XIV-8. Circuit diagram output circui

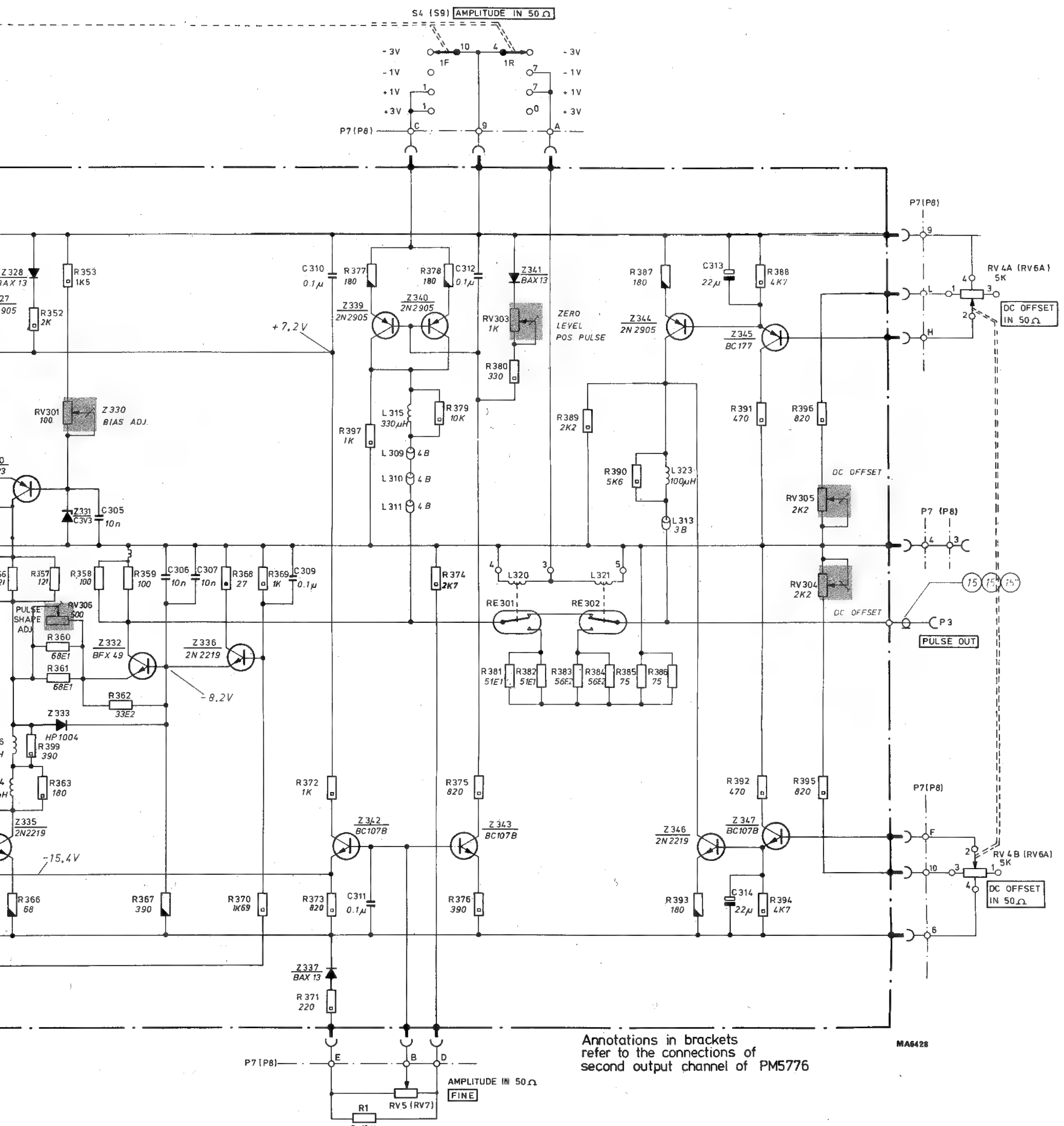


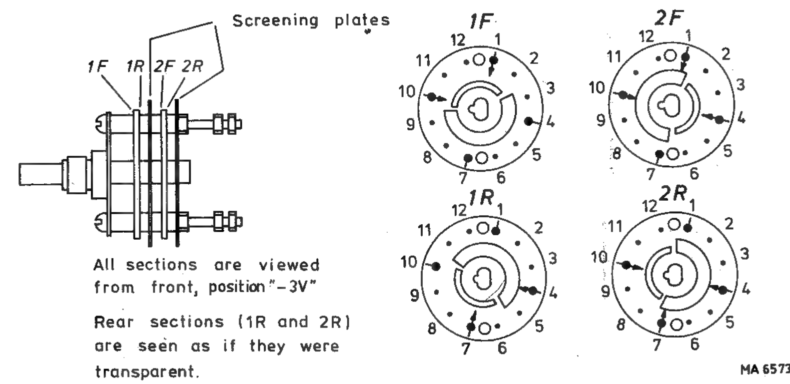
Fig. XIV-8. Circuit diagram output circuit (version –/01)

PM 5775

Connections at P7			
Pin No.	Lead colour	Connected to	D.C. voltage
1	white	P7-5	–20 V
2	–	–	
3	blue	c.b.2-40	0 V
4	–	–	
5	white	P7-1	–20 V
6	white	RV4B-4	–20 V
7	white	c.b.2-41	–20 V
8	–	–	
9	orange	S4-1R-4	+20 V
10	red	RV4B-2	
A	brown	S4-1R-7	
B	red	RV5-2	
C	yellow	S4-1F-1	
D	green	RV5-1	
E	violet	RV5-3	
F	grey	RV4B-3	
H	black	RV4A-1	
J	orange	c.b.2-38	+20 V
K	–	–	
L	brown	RV4A-2	

PM 5776

Connections at P7				Connections at P8			
Pin No.	Lead colour	Connected to	DC voltage	Pin No.	Lead colour	Connected to	DC voltage
1	white	P7-5	–20 V	1	white	P8-5	–20 V
2	–	–		2	–	–	
3	blue	c.b.2-40	0 V	3	blue	P7-4	0 V
4	blue	P8-3	0 V	4	–	–	
5	white	P7-1	–20 V	5	white	P8-1	–20 V
6	white	RV4B-4	–20 V	6	white	RV6B-4	–20 V
7	white	c.b.2-41	–20 V	7	white	P7-8	–20 V
8	white	P8-7	–20 V	8	–	–	
9	orange	S4-1R-4	+20 V	9	orange	S9-1R-4	+20 V
10	red	RV4B-2		10	red	RV6B-2	
A	brown	S4-1R-7		A	brown	S9-1R-7	
B	red	RV5-2		B	red	RV7-2	
C	yellow	S4-1F-1		C	yellow	S9-1F-1	
D	green	RV5-1		D	green	RV7-1	
E	violet	RV5-3		E	violet	RV7-3	
F	grey	RV4B-3		F	grey	RV6B-3	
H	black	RV4A-1		H	black	RV6A-1	
J	orange	c.b.2-38	+20 V	J	orange	P7-K	+20 V
K	orange	P8-J	+20 V	K	–	–	
L	brown	RV4A-2		L	brown	RV6A-2	



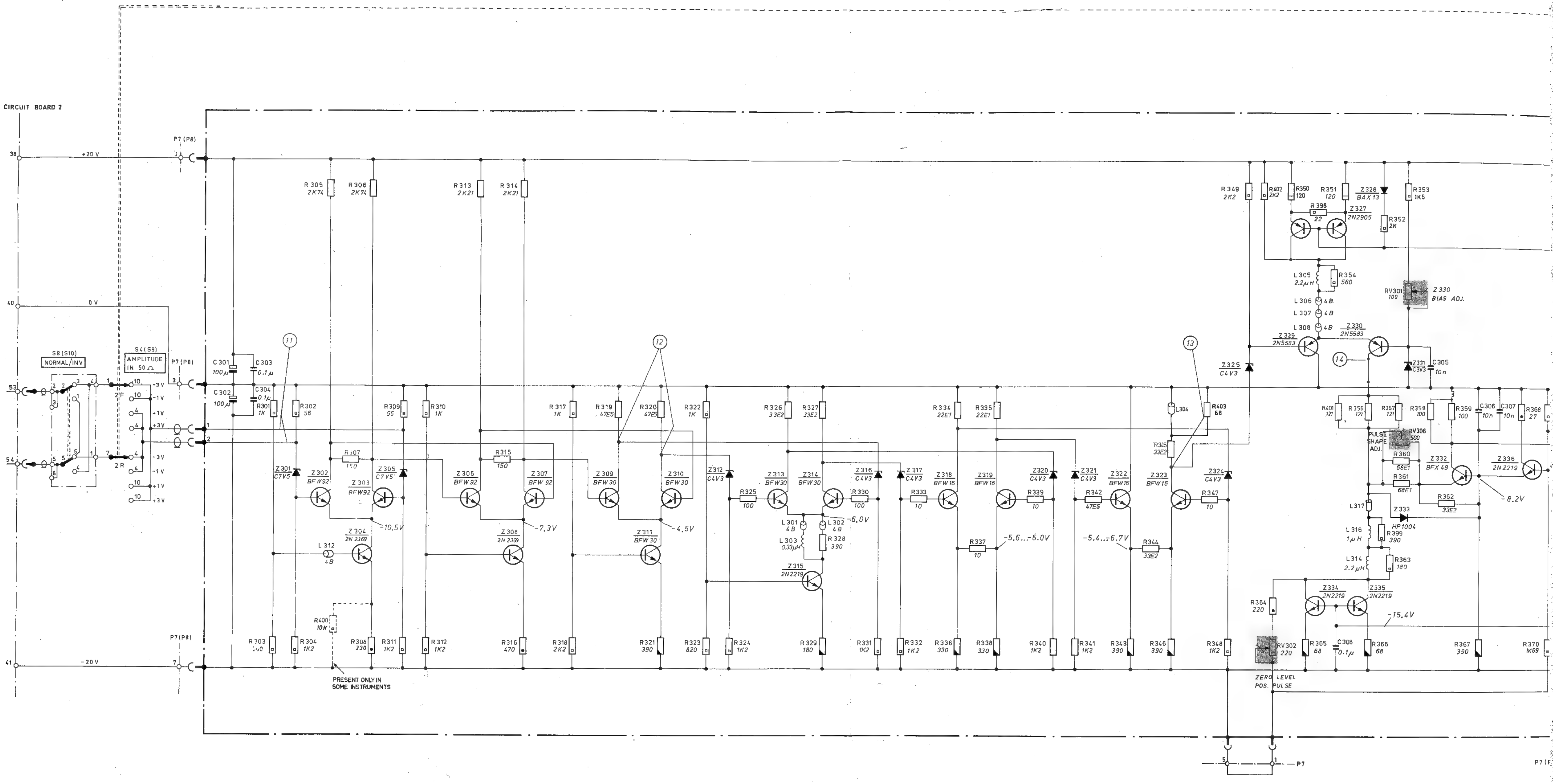
Attention

The parallel coupled resistors R358//R359 are connected directly to earth.

In fact they are connected to earth via a piece of wire serving as an inductance. The length and position of the wire are determined in the factory test room when adjusting the pulse risetime. Sometimes it has been necessary to connect the wire in parallel with a 10 Ω resistor.

NOTE:

This wire affects the pulse risetime and should not be moved by service personnel !


CIRCUIT BOARD 2
+20 V
0 V
-20 V
P7 (P8)
S8 (S10)
NORMAL/INV
S4 (S9)
AMPLITUDE IN 50 Ω
-3 V
-1 V
+1 V
+3 V
C 301 100μ
C 302 100μ
C 303 0.1μ
C 304 0.1μ
R301 1K
R 302 56
R 303
R 304 1K2
R 305 2K74
R 306 2K74
R 307 150
R 308 330
R 309 56
R 310 1K
R 311 1K2
R 312 1K2
R 313 2K21
R 314 2K21
R 315 150
R 316 470
R 317 1K
R 318 2K2
R 319 47E5
R 320 47E5
R 321 390
R 322 1K
R 323 820
R 324 1K2
R 325 100
R 326 33E2
R 327 33E2
R 328 390
R 329 180
R 330 100
R 331 1K2
R 332 1K2
R 333 10
R 334 22E1
R 335 22E1
R 336 330
R 337 10
R 338 330
R 339 10
R 340 1K2
R 341 1K2
R 342 47E5
R 343 390
R 344 33E2
R 345 33E2
R 346 390
R 347 10
R 348 1K2
R 349 2K2
R 350 120
R 351 120
R 352 2K
R 353 1K5
R 354 560
R 356 121
R 357 121
R 358 100
R 359 100
R 360 68E1
R 361 68E1
R 362 33E2
R 363 180
R 364 220
R 365 68
R 366 68
R 367 390
R 368 27
R 370 1K69
R 398 22
R 399 390
R400 10K
R401 121
R402 2K2
R403 68
RV301 100
RV302 220
RV306 500
Z 301 C7V5
Z 302 BFW92
Z 303 BFW92
Z 304 2N 2369
Z 305 C7V5
Z 306 BFW 92
Z 307 BFW 92
Z 308 2N 2369
Z 309 BFW 30
Z 310 BFW 30
Z 311 BFW 30
Z 312 C4V3
Z 313 BFW 30
Z 314 BFW 30
Z 315 2N2219
Z 316 C4V3
Z 317 C4V3
Z 318 BFW 16
Z 319 BFW 16
Z 320 C4V3
Z 321 C4V3
Z 322 BFW16
Z 323 BFW16
Z 324 C4V3
Z 325 C4V3
Z 326 BAX 13
Z 327 2N2905
Z 329 2N5583
Z 330 2N5583
Z 330 BIAS ADJ.
Z 331 C3V3
Z 332 BFX 49
Z 333 HP 1004
Z 334 2N2219
Z 335 2N2219
Z 336 2N 2219
C 305 10n
C 306 10n
C 307 10n
C 308 0.1μ
L 301 4B
L 302 4B
L 303 0.33μH
L 304
L 305 2.2μH
L 306 4B
L 307 4B
L 308 4B
L 312 4B
L 314 2.2μH
L 316 1μH
L 317
-10.5V
-7.3V
-4.5V
-6.0V
-5.6...-6.0V
-5.4...-6.7V
-8.2V
-15.4V
PULSE SHAPE ADJ.
ZERO LEVEL POS. PULSE
PRESENT ONLY IN SOME INSTRUMENTS
P7

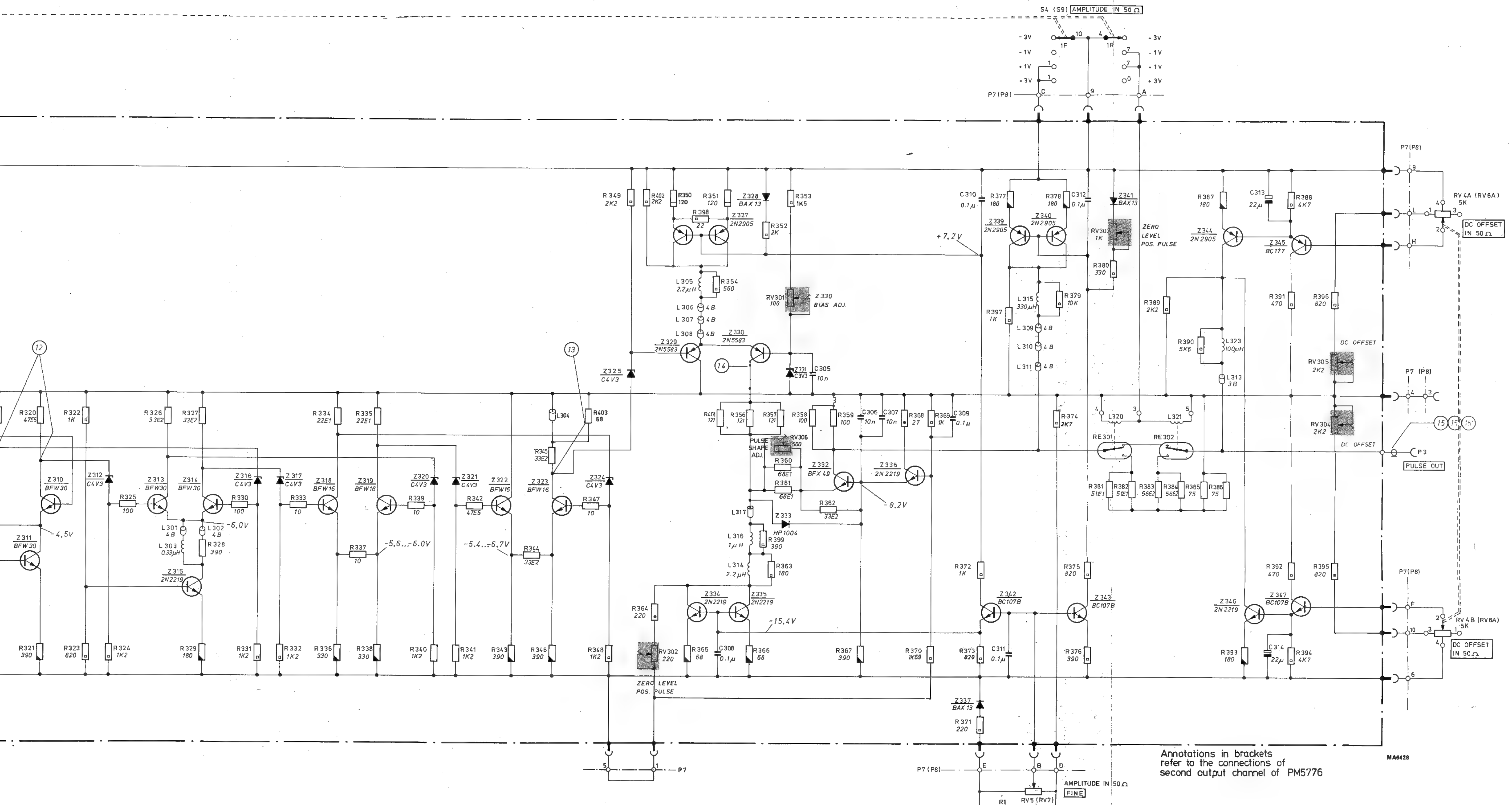


Fig. XIV-9. Circuit diagram output circuit (version –/02)

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JALITY REPORTING

DING SYSTEM FOR FAILURE DESCRIPTION

e following information is meant for Philips service workshops only and serves as a guide for exact reporting of vice repairs and maintenance routines on the workshop charts.
r full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for st and Measuring Instruments).

CATION

□□□□

Unit number
e.g. 000A or 0001 (for unit A or 1; not 00UA or 00U1)

Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

Unknown/Not applicable
0000

TEGORY

Unknown, not applicable (fault not present, intermittent or disappeared)
Software error
Readjustment
Electrical repair (wiring, solder joint, etc.)
Mechanical repair (polishing, filing, remachining, etc.)
Replacement
Cleaning and/or lubrication
Operator error
Missing items (on pre-sale test)
Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

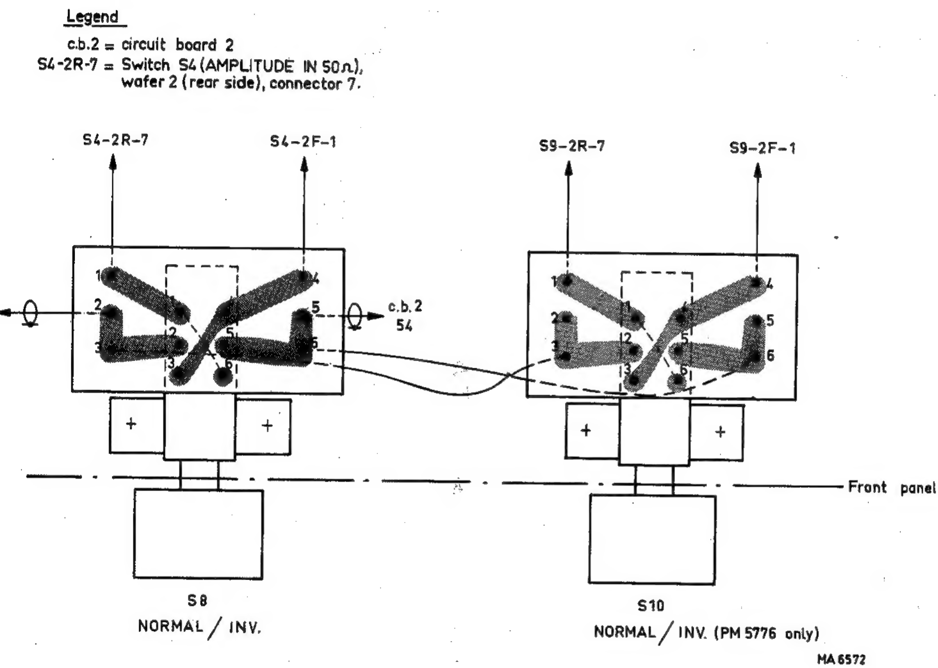
□□□□□□

Enter the identification as used in the circuit diagram, e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
RO....	Resistor, potentiometer
CO....	Capacitor, variable capacitor
BO....	Tube, valve
LA....	Lamp
VL...	Fuse
SK....	Switch
BU....	Connector, socket, terminal
TO....	Transformer
LO....	Coil
XO....	Crystal
CB....	Circuit block
RE....	Relay
ME....	Meter, indicator
BA....	Battery
TR....	Chopper

Parts not identified in the circuit diagram:

990000	Unknown/Not applicable
990001	Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous



IV-10. *Circuit board for NORM. INV. switch S8 (S10)*